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SOIL SURVEY
LAKE COUNTY, OHIO

BY

ARTHUR E. TAYLOR

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SOIL SURVEY

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SOIL SURVEY OF LAKE COUNTY, OHIO

By ARTHUR E. TAYLOR

COUNTY SURVEYED

Lake County is in the northeastern part of Ohio, about 10 miles east of Cleveland. Lake Erie forms its northern boundary. The county has an area of 234 square miles, or 149,760 acres.

Level plains, representing the beds of old glacial lakes and extending from 2 to 5 miles back from Lake Erie, and an undulating or rolling region, the surface features of which are largely the result of glaciation, constitute two well-defined physiographic divisions of the county. The topography is constructional. The county consists of undulating or gently rolling plains, dotted with rather prominent, isolated hills and deep valleys with abrupt slopes.

FIG. 1.—Sketch map showing location of Lake County, Ohio

The lake-bed plains comprise the greater part of the county. The plains area is traversed by three old glacial lake beaches, which consist of low gravel and sand ridges extending across the county in a northeasterly and southwesterly direction, roughly parallel to the present shore line of Lake Erie. Each of thes ridges represents the shore line of a large body of water, formed during the glacial period. The ridge nearest Lake Erie is locally known as North Ridge. It has an elevation of 680 feet above sea level, ranges in width from 100 to 200 yards, and rises abruptly from 10 to 20 feet above the region lying immediately north of it. This region is the bottom of the lake of which the ridge is the beach. This was the glacial lake described by Leverett as Lake Warren.[1] Another very well-known ridge, locally known as the South Ridge, has an elevation of 730 feet, is from 100 to 200 yards wide, rises from 10 to 20 feet above the lake-bottom plain immediately north of it, and is a beach remnant of the glacial lake described by Leverett as Lake Whittlesey. From one-fourth to one-half mile south of South Ridge are remnants of a gravel ridge which now appear as a series of sand and gravel ridges. These remnants range in altitude from 760 to 780 feet, in length from one-eighth to 1 mile, and in width from 100 to 300 yards. They lie from 5 to 20 feet above the adjacent regions. These ridges are remnants of the beach of the glacial lake known as Second Lake Maumee. In the northeastern part of the county and extending for several miles parallel to and midway between North Ridge and South Ridge is a well-marked gravel ridge which rises from 4 to 10 feet above the adjacent region, has an elevation of 740 feet, and a width varying from 100 to 200 yards. Another sand and gravel ridge, with an elevation ranging from 625 to 630 feet, extends for

[1] Monograph 41, U. S. Geol. Sur

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several miles roughly parallel to the lake shore in the vicinity of Salida. It is from 200 to 400 yards wide and stands from 5 to 10 feet above the surrounding plain.

Between these ridges are level or undulating plains slightly broken by small, isolated knolls and ridges and by the shallow valleys of Grand River, Chagrin River, and various smaller streams. Very few of the valleys in these old glacial lake-bed plains exceed 40 feet in depth; they range from one-half to 1 mile in width. The general elevation of the lake-bed plains ranges from 30 to 200 feet above Lake Erie.

In the undulating or rolling region, south of the lake plains and beach ridges, Chagrin and Grand Rivers have cut valleys from 200 to 300 feet deep but only from one-eighth to one-fourth mile wide. From one-half to 1½ miles back from these rivers and their principal tributaries erosion has dissected the plain most thoroughly and the land is very broken and hilly. Along these rivers and their main tributaries are two or three levels where well-defined terraces exist and a higher level where remnants of a very old terrace occur. Between the valleys are rather extensive undulating or gently rolling areas, ranging in altitude from 200 to 500 feet above Lake Erie. Rising abruptly out of these areas are more or less conspicuous hills, such as Little Mountain and Gildersleeve Mountain, whose elevations range from 100 to 200 feet above the surrounding plain. They are capped by a bed of conglomerate.

With the exception of some small streams that find their outlets in Lake Erie, the drainage waters of the western third of Lake County flow into Chagrin River and those of the remainder of the county into Grand River. Extensive, level interstream tracts occur north of Maumee and Whittlesey Beaches and in the southern parts of Leroy, Concord, and Kirtland Townships. In these areas natural run-off is extremely slow, and no well-developed natural drainage ways exist.

The first settlement in Lake County was made in 1796. The early settlers came from Connecticut, but later settlers came from all the New England States and from New York and Pennsylvania.

The present rural population is chiefly native born and consists mainly of descendants of the early settlers. During the last 20 years a number of people from Cleveland have been attracted to the county by the comparatively low-priced land. According to the 1920 census the population of Lake County is 28,667, of which 14,139 are urban. The rural population includes residents of all towns under 2,500. The distribution of the rural population is fairly uniform, and the density is reported as 60.3 persons to the square mile.

Painesville, the county seat and largest town, in the north-central part of the county; Wickliffe, Willoughby, and Mentor in the western part; and Perry, Madison, and Unionville in the eastern part are important railway shipping points. Fairport, the town second in population, is a leading harbor on Lake Erie. Along the shore of Lake Erie are numerous resorts which in the summer provide a most excellent local market for truck, poultry, and dairy products.

Lake County is well provided with transportation facilities. The New York Central and the New York, Chicago & St. Louis Rail-

roads and an interurban electric railway cross the county east and west and the Baltimore & Ohio Railroad runs across it north and south, almost bisecting it. Autobus lines connect all the leading towns with the principal towns of counties to the south, east, and west.

A system of water-bound pikes extends into almost all parts of the county, and in addition to these a number of macadam, gravel, and cinder roads provide more than 90 per cent of the rural population with well-improved roads. The dirt roads are systematically worked and when dry are suitable for automobile traffic. Mail and telephone service is available to almost all farms. Because of its proximity to Cleveland, Lake County has an excellent market for all farm products.

CLIMATE

Lake County has a temperate climate with rather short periods of extreme heat and cold. The mean annual temperature of 47.8° F., as recorded at Hillhouse, is representative of the undulating or rolling section in the southern half of Lake County. The mean annual temperature of 49.2° F., at Cleveland (Weather Bureau), is representative of most of the old glacial lake plains in the northern half of the county.

The average annual precipitation at Hillhouse is 40.18 inches and at Wickliffe is 33.49 inches. The average monthly precipitation is higher for every month of the year at Hillhouse than at Wickliffe. Wickliffe is located 2 miles from and 160 feet above Lake Erie, at an altitude of 740 feet, and Hillhouse is 11 miles from and about 420 feet above Lake Erie, at an altitude of 997 feet. The moisture-laden winds coming off Lake Erie from the west often fail to give up their moisture as they pass over Wickliffe, but as they rise to higher elevations to the east showers are common.

In general, the rainfall is well distributed throughout the year, but a study of the climatological data for the Hillhouse station for a period extending from 1893 to 1920 indicates that excessively wet springs when the total precipitation for April, May, and June, which averages 10.81 inches, exceeded 17 inches twice in 27 years, or an average of once in 14 years; and that three summer droughts, when the total precipitation for July and August, which averages 7.01 inches, was less than 4 inches, occurred three times in the 27 years, or an average of once in 9 years. The records of the Wickliffe station from 1895 to 1920 show that 14.62 inches was the maximum total precipitation for April, May, and June, but that there were four times in the 25 years when the total precipitation for July and August, which averages 6.29 inches, was less than 4 inches.

Lake Erie has a decidedly moderating effect on the temperatures of spring and fall. This is evidenced by a comparison of the data concerning killing frost, observed at the Cleveland (Weather Bureau) station at an elevation of 762 feet, from 1862 to 1920, and at Hillhouse, at an altitude of 997 feet, from 1893 to 1920. The average date of the last killing frost at the Cleveland station is April 15 and at the Hillhouse station is May 17, whereas the average date of the first killing frost is November 2 for the Cleveland station and October 9 for the Hillhouse station. Assuming that temperatures along

the shore of Lake Erie are about the same in Lake County as at Cleveland, these observations would signify that the frost-free season near Lake Erie is almost two months longer than in the undulating and rolling country in the southern part of Lake County.

Another factor which is the cause of considerable variation in the length of the frost-free season in Lake County is the topographic location in respect to air drainage. It is a well-known fact that points along and adjacent to the upper slopes of the Grand and Chagrin River valleys, where the cold air drains off down the slopes, are often entirely free from the severe killing frosts of the floors of the valleys, where the locations are favorable for the accumulation of the cold air from the valley slopes. Certain parts of the larger valleys, as well as some of the smaller valleys, are frequented by heavy fogs which modify the low temperatures, so that crops escape some of the later killing frosts in the spring and the earlier ones in the fall.

Other factors that tend to delay very materially the time of planting on the level and gently undulating lands are the heavy spring rains, together with poor natural drainage and a comparatively small amount of tiling or ditching. The water-soaked soils remain very cold until late in the spring. This greatly retards the planting and the germination of seed. Corn, for instance, will not germinate or grow under a temperature of 48° F.

The following tables of climatic data were compiled from the records of the Weather Bureau stations at Hillhouse and Wickliffe.

Normal monthly, seasonal, and annual temperature and precipitation at Hillhouse

[Elevation, 997 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1908)	Total amount for the wettest year (1902)	Snow, average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	28.9	68	−11	2.91	3.04	3.64	16.3
January	25.5	71	−24	2.90	2.27	2.04	15.0
February	22.9	68	−25	2.36	3.52	1.24	12.6
Winter	25.8	71	−25	8.17	8.83	6.92	43.9
March	34.6	83	−10	2.91	3.62	1.98	6.6
April	45.2	88	6	2.97	3.30	3.00	3.0
May	56.8	95	15	4.26	3.79	6.18	.1
Spring	45.5	95	−10	10.14	10.71	11.16	9.7
June	65.2	101	29	3.58	2.78	7.94	.0
July	70.5	106	38	3.86	1.90	8.75	.0
August	68.8	99	36	3.15	1.17	1.58	.0
Summer	68.2	106	29	10.59	5.85	18.27	.0
September	63.1	95	26	3.75	.73	5.13	Trace.
October	52.3	89	16	4.22	2.43	5.21	1.2
November	39.8	78	2	3.31	1.34	1.96	8.9
Fall	51.7	95	2	11.28	4.50	12.30	10.1
Year	47.8	106	−25	40.18	29.89	48.65	63.7

Normal, monthly, seasonal, and annual precipitation at Wickliffe

[Elevation, 740 feet]

Month	Precipitation			Month	Precipitation		
	Mean	Total amount for the driest year (1908)	Total amount for the wettest year (1902)		Mean	Total amount for the driest year (1908)	Total amount for the wettest year (1902)
	Inches	*Inches*	*Inches*		*Inches*	*Inches*	*Inches*
December	2.33	2.35	3.48	July	3.34	1.01	5.38
January	2.69	1.64	1.55	August	2.95	1.58	.74
February	1.88	2.71	1.73				
Winter	6.93	6.70	6.76	Summer	9.14	5.73	13.53
March	2.82	2.25	1.66	September	3.15	.47	3.97
April	2.65	2.26	2.14	October	3.22	1.04	5.71
May	3.06	1.74	5.07	November	2.52	1.00	2.26
Spring	8.53	6.25	8.87	Fall	8.89	2.51	11.94
June	2.85	3.14	7.41	Year	33.49	21.19	41.10

AGRICULTURE

In the early part of the nineteenth century, agriculture in Lake County centered about the production of corn, wheat, and vegetables for the family needs. Cattle were raised for milk, butter, and meat, sheep for wool and meat, and hogs for meat. Development was slow owing to poor roads, remoteness of markets, and swamps and forests which covered practically the entire region. The lack of drainage, together with the ague and fever that were prevalent in most of the region, impelled the early settlers to locate on the sandy and gravelly ridges. As the country became more settled and clearings were extended, the production of dairy products, principally cheese, became important. After 1825 agricultural activities were rapidly increased, and in 1850 the maximum area in general farm crops had been reached. Since the first nursery stock was produced in Lake County, sometime between 1845 and 1850, the nursery industry has gradually grown until Lake County now has 126 nurseries, among which are some of the largest in the United States. To-day, this industry is the most important line of agriculture pursued in Lake County.[2]

The Federal and State crop statistics show little change in the average yield of grain crops since 1850, but there has been some change in the acreage devoted to the leading cereal crops. From 1850 to 1867 these crops, named in the order of their acreage, were corn, wheat, and oats; from 1880 to 1889 they were oats, wheat, and corn; and from 1870 to 1879, 1890 to 1909, and in 1920, they were oats, corn, and wheat. From 1850 until the present time hay has led all crops in acreage. The maximum acre yield of corn was reached between 1880 and 1890 and of wheat between 1890 and 1900.

[2] LLOYD, W. A. THE AGRICULTURE OF OHIO: HISTORY OF OHIO AGRICULTURE. Bul. 326, Ohio Agr. Exp. Sta. July, 1918.

Corn is the most important of the general farm crops. The census report shows that in 1919 the 7,723 acres planted to corn yielded 283,195 bushels. Corn is raised in all parts of the county and on all the soils. A considerable acreage of corn is used for silage. Where allowed to mature it is used to feed the livestock on the farm. Reid Yellow Dent and Leaming are the leading varieties. Large quantities of sweet corn of the Golden Bantam, Evergreen, and other varieties are grown, pulled green, and marketed at Cleveland.

In 1919, according to the 1920 census, the acreage of oats which ranks next to corn in importance, was 9,013 acres, and the average yield was 31.7 bushels to the acre. The increase in the acreage of oats was steady between 1850 and 1919. About 90 per cent of the oats is used for feeding purposes on the farms, and the remainder is sold.

Wheat, the cereal crop third in both value and acreage, according to the last census report, was grown on 4,306 acres and yielded 91,239 bushels. The leading varieties grown were Fulhio and Trumbull. State and Federal statistics indicate that there has been little change in the acre yield during the last 70 years, but it is generally considered that there has been a gradual decline in wheat yields, except where commercial fertilizers have been used. Commercially, wheat growing in Lake County is generally rated by farmers as unprofitable, owing largely to the disastrous work of the Hessian fly, chinch bug, rust, scab, and smut, and to the frequent thawing and freezing of the ground, which causes heaving and breaking of the root systems. The value of wheat as a nurse crop for clover and as a winter cover crop would seem to warrant its retention in the usual rotation of corn, wheat, and mixed timothy and clover. Most of the wheat is shipped out of the county.

Hay exceeds all other crops in acreage. The census report shows that in 1919, 16,321 acres were devoted to tame or cultivated grasses which yielded 23,552 tons. Mixed red clover and timothy, where the drainage is fair or good, and mixed alsike clover and timothy, where the drainage is poor, constitute the predominant hay crops. Alfalfa is grown in fields ranging in size from 1 to 12 acres, on soils that have been heavily limed.

Soy beans are increasing in favor, particularly among nurserymen, as a soil builder and for the development of a good physical condition of the seed bed. Farmers grow soy beans on small patches for hay and grain. When clover fails, soy beans are sometimes sown at corn planting time and harvested in the fall for hay or seed.

Rye, which in 1919 was grown on 1,714 acres, gave an average yield of about 16 bushels to the acre. Rye is grown largely on the sand soils. It takes the place of oats in the rotation and is sometimes plowed under as a green-manure crop preceding corn. It is used as a nurse crop when seeding some of the lighter soils to grass and clover, as it makes less demand on the supply of soil moisture than either oats or wheat.

Potatoes, because of their resistance to acidity, are an important crop on Mahoning silty clay loam and the more acid soils of the county. Climatic conditions have caused a wide variation in the

yield from year to year. In 1909, the average was 88.3 bushels and in 1919 was 59.6 bushels. In 1919, 1,932 acres of potatoes were harvested. A large part of the crop is marketed at Cleveland.

Buckwheat, according to the census of 1920, was grown on 832 acres in 1919, with an average yield of 22 bushels to the acre. It is often grown following the failure of wheat or corn and is occasionally plowed under as green manure.

Tomatoes and general truck crops are grown throughout Madison, Perry, Painesville, and Mentor Townships.

The manufacture of maple sirup is important in Leroy, Concord, and Kirtland Townships. The 1920 census reports 38,032 maple trees, producing 11,962 gallons of sirup and 500 pounds of sugar in 1919.

Commercial fruit growing is more or less developed in all the townships of Lake County. Apples are the most important fruit, followed by peaches, pears, cherries, and plums. In many orchards the yields are only fair, owing in part to poor location or to lack of proper tillage, pruning, spraying, or fertilizing. Most of the fruit is either sold at stands along the leading highways or is hauled by auto trucks to Cleveland. According to the census, there were 53,573 apple trees in the county in 1919, 97,163 peach trees, 26,641 pear trees, 11,397 cherry trees, and 8,075 plum and prune trees. The production for 1919 was 158,560 bushels of apples, 30,840 bushels of peaches, 7,098 bushels of pears, 3,673 bushels of cherries, and 1,442 bushels of plums and prunes. The 761,600 grapevines in the county yielded 5,007,714 pounds of grapes in 1919. One hundred and forty-three acres of strawberries produced 367,717 quarts, 202 acres of raspberries produced 218,128 quarts, and 21 acres of blackberries and dewberries produced 19,713 quarts.

Some of the principal varieties of apples grown are the Stayman Winesap, Stark Delicious, York Imperial, Jonathan, Baldwin, and Grimes Golden. The varieties of peaches include the Elberta, Champion, and Crosby. The Concord, Niagara, and Catawba varieties of grapes, the Cumberland variety of black raspberry, the Cuthbert variety of red raspberry, the Eldorado blackberry, and Progressive everbearing variety of strawberry are the principal varieties grown.

Dairying is carried on by the majority of the farmers of Lake County. Guernsey and Holstein cattle are more numerous than those of other breeds, but there are a few herds of Brown Swiss and Ayrshire. The Jersey is the main family cow. A number of the dairy herds in the county are purebred, but by far the greater proportion is grade stock. Practically all the sires are purebred. A large part of the dairy products, which consist of milk and cream, is shipped by railroad, interurban lines, and automobile trucks to Cleveland. The value of dairy products in 1919, excluding those consumed at home, according to the census, amounted to $656,362.

A minority of the farmers raise hogs for their own use. The Duroc-Jersey, Poland China, and Chester White are the predominating breeds. About 20 farmers have small flocks of Shropshire sheep. Most farmers have from 100 to 200 chickens, and a number on small farms specialize in poultry. The White Leghorn and Rhode Island Red are favorites on poultry farms, but the average farmer prefers the Barred Plymouth Rock, White Plymouth Rock, and Wyandotte.

The surface features and drainage of the soils determine to a considerable degree their agricultural use. Practically all the Holly, Tyler, Trumbull, Chippewa, Allis, Caneadea, Lorain, Reynolds, Wickliffe, and muck soils, where artificial drainage has not been established, are used as permanent pastures. The steep valley, gully, and terrace escarpment slopes are used as permanent pastures or wood lots.

All the farmers recognize differences in the adaptation of certain crops to the soils and the majority are guided in a measure by such adaptation in selecting soils and crops. It is generally recognized that the Berrien, Chenango, and Painesville soils are adapted to the production of peaches, berries, nursery stock, and general truck crops. The Reynolds, dark-colored phases of the Lorain, and muck soils, when properly drained, are recognized as the best soils in the county for trucking. It is known that red clover, alfalfa, and sweet clover do well on the Caneadea, Chagrin, Chenango, Lorain, Painesville, Tyler, and Reynolds soils with less liming than on other soils of the county. The Chagrin, Reynolds, Lorain, and muck soils are considered the best corn soils, although the Tyler, Mentor, Painesville, Caneadea, Chenango, Chippewa, and Holly are also recognized as corn soils. Corn, oats, mixed alsike clover and timothy, and apples are generally considered the profitable crops for the Mahoning, Trumbull, Chippewa, and Allis soils. The Lordstown soils are known to be best suited to peaches, apples, pears, berries, grapes, and truck crops.

Although the maximum corn crop was produced between 1870 and 1880, the maximum oats crop between 1880 and 1890, and the maximum wheat crop between 1890 and 1900, yet it is a fact that the farmers of Lake County are effecting an improvement in agriculture. Fall plowing is commonly practiced on the heavier soils, it being realized that the heavier soils disintegrate under the action of freezing and thawing so that a good seed bed can be prepared readily in the spring. Tractors are used extensively, particularly in breaking the heavy soils, as the period is usually brief when the moisture content is suitable for pulverization, and rapid work is imperative. Effective drainage systems have been installed on much of the naturally poorly drained soils.

In an effort to learn the crops best suited to the different soils and the treatment through which the largest yields may be obtained, demonstration fields have been established in different parts of the county through cooperation of farmers and the Ohio State University extension service. Dairymen of Lake County are cooperating with the State and Federal Governments in the eradication of bovine tuberculosis. Many farmers select their seed corn and make germination tests before planting. Vaccination against hog cholera has proved popular, and the loss from this disease has been very materially reduced. Poultry culling is practiced extensively.

The land is usually plowed and worked into a fairly good seed bed for oats. In a comparatively small number of cases corn-stubble ground is disked and harrowed, and the seed is drilled among the stalks.

In growing wheat the usual practice is to plow in early August or September and drill in the wheat after the period of emergence of the Hessian fly has passed. This is usually between September 6 and 20. Considerable care is exercised in obtaining a thoroughly pulverized and, on the lighter soils, a compacted seed bed. On most farms superphosphate (acid phosphate) is drilled in with the wheat at the rate of 150 pounds to the acre. Winter wheat does best if the moisture content is right to germinate the seed and allow a strong root growth before freezing weather, but too much moisture causes heaving, surface rooting, and inability to withstand cold and drought.

The common method of preparing the seed bed for corn is to cover the sod with stable manure and then plow it to a depth varying from 5 to 8 inches. Dead furrows, 2 or 3 rods apart, are laid off for surface drainage in the poorly drained soils.

Farm buildings commonly consist of a substantial frame house, a large barn, implement shed, poultry house, and silo. The barn provides ample room for housing the livestock and storing crops for the winter. Sanitary conditions are maintained on the dairy farms, the water usually being pumped from deep drilled wells either by windmills, gas engines, or electric motors. Nearly all tillage operations are performed with riding implements. Considerable tiling has been done on the poorly drained soils, and where the tile have been properly installed the increase in crop production has in various cases paid all costs of tiling within eight years or less. Except for inclosing permanent pastures, fencing receives little attention. The census for 1919 reports the average value of all property to the farm as $16,740.

The crop rotation generally practiced in Lake County consists of corn, oats, and mixed timothy and clover, red clover being used on the fairly well drained or well-drained land and alsike clover on poorly drained land. Wheat, barley, rye, or soy beans sometimes take the place of oats. Another rather common rotation is corn, oats, wheat, and mixed timothy and clover. Potatoes often take the place of corn. For the purpose of increasing the fertility of the soils, many nurserymen use soy beans as a green-manure crop.

The extension of nursery acreage and the continuous cropping of the soils with consequent decrease in their productiveness has caused the use of commercial fertilizers and manure to increase rapidly. According to the census the expenditure for fertilizers is as follows: In 1879, $11,918; in 1889, $25,295; in 1899, $26,140; in 1909, $60,585; and in 1919, $94,878. For general-farming purposes the main mineral fertilizer is superphosphate (acid phosphate). Fertilizers are commonly applied at planting time, corn, oats, and wheat receiving from 150 to 250 pounds of commercial fertilizer and potatoes from 300 to 400 pounds to the acre. Sod land is manured when it is to be planted to corn, and it is a common practice to give wheat a top-dressing of manure during the winter. Apple and peach orchards receive applications of sodium nitrate or ammonium sulphate, and special fertilizers are used for truck crops and nursery stock.

Fine-ground limestone or its equivalent in other forms of lime has been used on all the soils of Lake County, with the exception

of the Chagrin and Holly soils, with good results. The Caneadea, Lorain, Chenango, Mentor, Painesville, muck, Reynolds, and Tyler soils are acid in the upper horizon, are only slightly acid below a depth varying from 8 to 12 inches, and are neutral below a depth varying from 12 to 16 inches. These soils require about 1½ tons of limestone to the acre for red clover and 2½ tons for alfalfa and sweet clover. The Mahoning, Chippewa, and Trumbull soils are strongly acid in both the topsoil and subsoil to a depth varying from 24 to 36 inches, where they become slightly acid; at a depth varying from 36 to 48 inches they become neutral. An application of 2½ tons of limestone to the acre is needed on these soils for red clover and at least 3½ tons for alfalfa. The Allis, Wickliffe, and Lordstown soils are very acid throughout the topsoil and subsoil. Three tons of ground limestone to the acre are needed to neutralize the acidity in the surface layers so that red clover can be successfully grown. Because of the strong acidity of the lower horizon it would be difficult to grow deep-rooted legumes, such as alfalfa and sweet clover, successfully. In acid soils lime is essential for good results with red clover, and the yields of grain and other crops are often decidedly increased by its use. In many cases the nitrogen supply is maintained principally by the growing of legumes.

Farm labor, since the World War, has been difficult to obtain, owing to the higher wages and shorter hours offered by manufacturing enterprises in Cleveland and other near-by cities and by companies that are developing subdivisions in the county. On farms ranging from 40 to 160 acres in size, the members of the family do most of the farm work, but when extra help is needed, as during threshing and silo filling, the exchange of help among neighbors is common. On the nursery farms and some large farms that are used for general farming most of the labor is hired. Monthly wages for the farm hands range from $40 to $60 with board and laundry. Day laborers receive from $3.50 to $5. The census reports $871,520 paid for farm labor during the year 1919, or $927.04 for each of the 940 farms reporting. This high cost of labor to the farm is caused by the large labor requirements on the 126 nursery farms.

Although farms range in size from 20 to 3,000 acres, from 50 to 80 acres is the general range. The average size of farms decreased from 90 acres in 1880 to 65.4 in 1920.

Farm land is rented mainly on the share basis. Usually the landlord furnishes one-half the dairy cattle and receives one-half of the income from the farm. Where land is rented for cash, from $2 to $10 an acre is paid. The 1920 census reports 76.5 per cent of the farms operated by the owners, 16.7 per cent by tenants, and 6.8 per cent by managers.

Land values in Lake County, with the exception of the southeast quarter, are very largely dependent on favorable location for country estates and allotments for residential purposes. In the southeast quarter of the county the values are determined by the character of the farm improvements and the location with respect to road improvements, railroads, and towns. The average assessed value in 1920 was $166.29 an acre.

SOILS

The soils of Lake County are prevailingly light in color. This is explained by the fact that they were formed under a dense forest cover which was unfavorable for a heavy development of grass roots and for the accumulation of much organic matter in the soil. Furthermore, these soils have been developed under the influence of a temperate climate where the amount of rainfall has been sufficient to compensate the loss of moisture by evaporation and surface runoff and in addition to afford almost a constant supply for downward movement through the soil. Under these conditions the soil materials have undergone chemical and physical changes that have so modified them that the original geologic characteristics of the material have given place to the subsequently developed true soil characteristics. The carbonates have been leached from these soils to a depth ranging from 4 to 5 feet.

In forested areas, the essential features of the typical soil profile of well-drained, moderately heavy textured material in which oxidation and leaching have been effective to a depth varying from 30 to 40 inches are as follows: The topsoil consists of a 1-inch or 2-inch layer of a very dark brown mixture of partly decayed leaves, forest litter, leaf mold, and humus soil, underlain by a layer, from 6 to 10 inches thick of mixed mineral and organic matter which has a dark grayish-brown color in the upper part but which becomes lighter colored with increasing depth. The dark color is imparted largely by the finely divided organic matter derived mainly from the decay of plant roots and intimately mixed with the mineral constituents of the soil. Beneath this layer of mineral soil the second horizon or subsoil is from 5 to 30 inches thick and consists of yellowish-brown material distinctly heavier than that of the horizon above or below it. This is the zone of concentration of clay and sesquioxides, and it receives material removed from the layers above. The material underlying this horizon and constituting the third horizon, or substratum, is brownish yellow in color and is slightly calcareous at a depth ranging from 48 to 60 inches. Soils having this profile have been grouped in the Chenango and Mentor series.

The poorly drained soils underlain by glacial till have developed a fairly uniform profile, consisting of three distinct horizons, including the parent material. The upper horizon, or topsoil, consists of a thin covering of humus soil containing partly decayed leaves, twigs, and roots, immediately underlain by a layer of granular organic silt loam which varies in color from brownish gray in the upper part to light brownish gray in the lower part. The total thickness of this layer varies from 5 to 7 inches, and pH values indicate an acid reaction. The second horizon, or subsoil, has a decidedly heavier texture and is more plastic than the first horizon and is somewhat heavier and decidedly more plastic than the third horizon. The color is mottled light yellowish gray, brownish yellow, and light grayish yellow, the thickness varies from 22 to 26 inches, and the pH values indicate a very acid reaction. The third horizon, or substratum, consists of two distinct layers, the upper of which is light grayish-yellow, mottled with whitish-gray and light yellowish-gray, brittle, friable

material. This layer is from 20 to 40 inches thick, and the pH values vary widely in the different soil types. The lower layer is mottled whitish-gray, brownish-yellow, light yellowish-gray, and light grayish-yellow, brittle, hard, slightly calcareous glacial till. This is the soil profile for the Mahoning soils and of the Trumbull soils which have a glacial till substratum. The profile of the Chippewa soils is like the one described, except that the topsoil is dark gray.

The poorly drained soils with a sandstone, interstratified sandstone and shale, or shale substratum, have developed three horizons. The upper horizon, or topsoil, consists of a thin layer of leaf litter, vegetal mold, fine roots, and forest débris in various stages of decomposition, underlain by a layer of gray, silty, finely granular material which is very poor in organic matter. The thickness of this horizon is from 5 to 8 inches, and the pH values indicate high acidity. The second horizon, or subsoil, is much heavier in texture than the first horizon and is somewhat heavier than the third horizon. It is mottled gray, light gray, yellowish gray, yellow, and brownish yellow, is from 20 to 50 inches thick, has a very acid reaction, and rests on the third horizon, or substratum. This layer consists of weathered shale in the Wickliffe soils; of interstratified shale and sandstone in the Allis soils; and of interstratified shale and sandstone in part of the Trumbull soils. This horizon is also very acid in reaction.

Imperfectly developed profiles are formed in the very poorly drained soils which have water-laid substrata. A generalized section of the heavier members of these soils shows an upper horizon, or topsoil, consisting of a layer about 1 inch thick of vegetal mold, partly decayed leaves and grasses, fine roots, and litter, grading to a 3-inch layer of dark olive-gray finely granular material underlain by a 2-inch layer of gray finely granular material. Electrometric determinations indicated a range in the pH values of this horizon from 5.8 to 6.2. The second horizon, or subsoil, has a finely granular structure, a mottled light-gray, grayish-yellow, yellowish-brown, and brownish-yellow color, and a distinctly heavier texture than the first horizon. The lower limit of this horizon is not definite, there being scarcely any change in the texture, color, consistence, and structure between depths of 7 and 60 inches. Electrometric determinations of the pH values indicate moderate acidity between depths of 10 and 20 inches and slightly less acid reactions between depths of 20 and 36 inches. Below this are the slightly calcareous, laminated, lacustrine, or fluvial silty clays of the unleached part of the third horizon or substratum. Soils that have this profile include members of the Lorain, Caneadea, Reynolds, and Tyler series.

In other imperfectly developed soils in Lake County the drainage is good, but the parent formation, which is sandstone, occurs in most places at a depth varying from 1 to 3 feet below the surface. In the generalized profile of these soils there are two horizons, the upper one, or topsoil, consisting of grayish-brown or dark grayish-brown, friable, silty material underlying a thin covering of leaf mold and litter. This layer is about 7 inches thick. Immediately beneath it is the second horizon, or subsoil, which is distinctly heavier, is light grayish yellow or yellow, and is from 5 to 30 inches thick.

Another imperfectly developed soil occurs in areas where lacustrine clay lies at a depth ranging from 15 to 40 inches. This soil apparently has no genetic relation to the material overlying it. It consists of two horizons. The upper horizon, or topsoil, is about 8 inches thick and consists of two layers, the upper layer being dark grayish-brown, friable material underlying a thin covering of vegetal mold and leaf litter, and the second, occurring at a depth of about 4 inches, consisting of grayish-brown, friable material. Beneath this is the second horizon, or subsoil, which is heavier and has a yellowish-brown color. The thickness of this layer ranges from a few inches to 2 feet. In many places this material rests on stratified beds of sand which overlie silty clay. The Painesville soils have this profile.

The color horizons have been partly developed in the Berrien soils. In these soils a thin layer of leaf mold and forest litter covers dark-brown, loamy material which, at a depth of about 3 inches, is underlain by an 8-inch layer of brown, loamy material. Beneath this is yellowish-brown material.

The flood-plain soils grouped in the Chagrin and Holly series have no distinct soil profile.

About 70 per cent of the soil material of Lake County consists of water-laid deposits, consisting mainly of lacustrine beds, with a minor quantity of glacial outwash material and fluvial deposits along streams; 25 per cent is glacial till; 3 per cent is shale and sandstone; and 2 per cent is peat and muck.

The glacial drift is closely related to the underlying rocks. It is composed largely, where weathering has not affected it, of ground sandstone and shale, although there is a small admixture of chert, quartz, quartzite, granite gneiss, and various other meta-igneous gravels and bowlders.

Through weathering, the surface of the drift has been, to a large degree, transformed from a heterogeneous mass to a material having uniform texture and structure. The most outstanding characteristics are the results of soil-forming processes such as the accumulation of organic matter, oxidation, leaching, and the development of soil horizons by the translocation of materials, rather than of variations in the character of the parent material.

Peat and muck have originated from the partial decomposition of organic material in the presence of water.

The groups of soil heretofore described are subdivided into series on the bases of difference in structure, color, consistence, degree of leaching, and minor details of the soil profile, and the source, character, and processes of accumulation of the material from which the soils have been derived. A further differentiation into types has been made on the basis of the texture of the surface soil. Minor variations in the soil, not sufficient to produce type or series differences, are indicated as soil phases.

In the following pages of this report the different soils are described in detail and their agricultural uses and possibilities are discussed; their distribution in the county is shown on the accom-

panying soil map; and their actual and proportionate extent is shown in the following table:

Acreage and proportionate extent of soils mapped in Lake County, Ohio

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Mahoning silty clay loam	32,256	29.4	Lorain silty clay loam	2,240	1.6
Rolling phase	11,840		Dark-colored phase	192	
Caneadea silty clay loam	6,464	7.1	Lorain loam	1,536	1.2
Dark-colored phase	4,160		Dark-colored phase	320	
Caneadea loam	7,552	5.7	Lorain silty clay	1,088	.7
Gravelly phase	832		Lorain fine sandy loam, dark-colored phase	256	.2
Caneadea silty clay	1,472	5.3	Reynolds very fine sandy loam	1,344	1.3
Dark-colored phase	6,400		Light-textured phase	640	
Caneadea very fine sandy loam	2,752	1.8	Reynolds fine sandy loam	1,088	.7
Caneadea fine sandy loam	2,432	1.8	Trumbull silty clay loam	3,904	2.6
Light-textured phase	256		Allis silty clay loam	3,008	2.1
Caneadea silt loam	512	.4	Rolling phase	192	
Chenango gravelly fine sandy loam, beach-ridge phase	6,336	4.2	Lordstown loam	768	.5
Chenango gravelly loam	704	4.0	Lordstown fine sandy loam	256	.2
Beach-ridge phase	5,248		Lordstown silt loam	192	.1
Chenango loam	2,688	1.8	Chippewa silty clay loam	256	.2
Chenango gravelly fine sand, beach-ridge phase	2,688	1.8	Tyler silty clay loam	576	.4
Chenango very fine sandy loam	512	.4	Wickliffe silty clay	1,664	1.1
Berrien very fine sand	5,696	3.8	Wickliffe silty clay loam	448	.3
Berrien fine sand	2,048	1.8	Chagrin silt loam	3,840	2.6
Beach-ridge phase	576		Holly silty clay loam	2,688	1.8
Mentor silt loam	1,856	3.0	Holly silt loam	768	.5
Mottled-subsoil phase	2,688		Muck	320	.2
Mentor loam	320	.2	Peat	896	.6
Painesville very fine sandy loam	3,584	2.4	Marsh	192	.1
Painesville fine sandy loam	1,536	1.0	Rough broken land	7,232	4.8
Painesville silt loam	448	.3	Total	149,760	

MAHONING SILTY CLAY LOAM

The virgin surface layers of dry Mahoning silty clay loam include a 1-inch layer of a mixture of silt and disintegrated and partly decomposed organic matter, underlain by a 3-inch layer of brownish-gray friable silt loam which grades to light brownish-gray silt loam about 2 inches thick. Below this the texture becomes silty clay loam and the color light grayish yellow with faint grayish-yellow and yellowish-gray mottles. This grades, at a depth of 8 inches, to mottled light yellowish-gray, brownish-yellow, and light grayish-yellow, rather plastic silty clay loam or silty clay underlain, at a depth of about 30 inches, by light grayish-yellow silty brittle clay, mottled with gray and light yellowish gray. This, at a depth ranging from 48 to 56 inches, rests on mottled whitish-gray, brownish-yellow, light yellowish-gray, and light grayish-yellow, brittle, silty clay which contains some lime (CO_2 from carbonates, 2.97 per cent in one sample).

South of Wickliffe is an area of Volusia silty clay which, owing to its small extent, has been included with Mahoning silty clay loam in mapping. In places the material between depths of 8 and 30 or more inches consists of highly mottled light yellowish-gray, light grayish-yellow, and brownish-yellow heavy silt loam or light silty clay loam which rests on light grayish-yellow brittle clay with whitish-gray and light yellowish-gray mottles. In other small areas from one-half to 1 mile south of Wickliffe, the material below a depth of about 8 inches is light grayish-yellow silty clay loam with

light yellowish-gray and brownish-gray mottles. This, at a depth of about 18 inches, grades rather abruptly to very brittle, hard, friable silty clay. One mile north of Little Mountain and east of Indian Point are areas, which in the aggregate will not exceed 2 square miles, of Canfield silty clay loam. In these the soil consists of light brownish-gray silt loam grading, at a depth of 7 or 8 inches, to light grayish-yellow heavy silt loam or light silty clay loam which, at a depth of about 20 inches, is underlain by light grayish-yellow silty clay loam with light yellowish-gray and brownish-gray mottles. Below a depth varying from 28 to 34 inches is light grayish-yellow, brittle silty clay loam with mottles of light gray, brownish gray, and light yellowish gray. Included in mapped areas of Mahoning silty clay loam and lying between Paine Creek and Grand River are small areas of silty clay loam in which the material between depths of 8 and 20 inches is light grayish-yellow silty clay loam, slightly mottled with yellowish gray and brownish yellow. This is underlain by mottled light yellowish-gray, brownish-yellow, and light grayish-yellow plastic silty clay, which at a depth of about 30 inches grades to light grayish-yellow brittle clay mottled with light gray and light yellowish gray.

Electrometric determinations of the pH values[3] of the various layers of a typical virgin profile of Mahoning silty clay loam gave the following results: 5.10 from 0 to one-half inch, 4.91 from one-half to 4 inches, 5.14 from 4 to 8 inches, 4.76 from 8 to 24 inches, 5.48 from 24 to 56 inches, and 8.12 from 56 to 66 inches.

About 80 per cent of this soil in Lake County is cultivated. The cultivated soil differs from the virgin in that the surface layers have been mixed together and greatly modified by the addition of manure and commercial fertilizers. Much of the soil is lighter in color than when it was first broken, indicating a probable depletion in the supply of organic matter. Under normal moisture conditions the tilled soil, to a depth of 7 inches, is light grayish-brown friable silt loam, but when wet the color is brownish gray. This soil is cold, is deficient in organic matter, and is very acid. Great care should be exercised to work it when the moisture content is right for pulverization.

Mahoning silty clay loam is the most extensive soil in the county and comprises most of the area lying south of the South Ridge.

The surface is level, undulating, or gently sloping. The surface run-off is slow, and the compact impervious subsoil layers very greatly impede the movement of ground water and make it difficult to accomplish successful artificial drainage. In most places where 4-inch tiles have been set at intervals of 2 rods and at a depth varying from 30 to 36 inches, fair underdrainage has been established.

The virgin tree growth consisted largely of hard maple and beech, with some red oak, scarlet oak, white oak, black oak, white ash, hemlock, hickory, ironwood, and dogwood. Soft maple, bur oak, swamp white oak, elm, and black ash grew on the more poorly drained land.

The principal type of agriculture on this soil consists of general farming in conjunction with dairying, although many commercial apple and pear orchards, vineyards, and some nurseries are to be found. Almost all the hay and grain produced is fed to livestock on

[3] Determination of pH values by E. H. Bailey, Bureau of Chemistry and Soils.

the farm. According to the estimates of farmers there is about one dairy cow to each 10 acres of land. Corn yields, on an average, about 37 bushels to the acre, hay about 1 ton, oats 45 bushels, wheat 16 bushels, and soy beans 16 bushels.

Most farmers practice a rotation consisting of corn, oats, and mixed alsike clover and medium red clover with timothy. Sometimes potatoes take the place of corn and wheat of oats. Cornland and wheatland usually receive from 125 to 150 pounds to the acre of superphosphate (acid phosphate) fertilizer, and potatoes from 300 to 400 pounds. Many farmers practice fall plowing.

Current land values range from $50 to $100 an acre for strictly agricultural land, but where there is a demand for allotments the selling price ranges from $200 to $1,200 an acre.

One of the essentials in managing this soil is the increase and maintenance of the supply of organic matter. The organic matter tends to increase the moisture-holding capacity, retards loss of moisture by surface evaporation, aids in warming the soil by the absorption of heat, helps to control erosion on the more rolling areas, helps to overcome the tendency to run together or puddle, gives better tilth, and in decomposing supplies nitrogen and tends to liberate other plant-food elements. Organic matter can best be supplied by growing leguminous crops, including clover, cowpeas, alfalfa, and sweet clover. Because of its acidity, it would be well to mix thoroughly with the soil about 3 tons of finely pulverized limestone applied on plowed land before planting in the fall or in the spring. The ground limestone will greatly assist in obtaining a good stand of clover, alfalfa, or sweet clover. This soil must be tiled before the best results can be realized. By removing the excess water in the early part of the season, crops are allowed to root much deeper, so that when drought comes they have a greater depth of soil from which to draw their moisture supply. Farmers who have succeeded with tile drainage on this soil state that properly laid tile, at current prices for labor and materials, will pay the cost of installation in increased crop production in eight years or less. Where 4-inch drain tile are set at a depth ranging from 30 to 36 inches and at intervals of 2 rods, fair underdrainage is in most places obtained. Plowing under, to a depth of 8 inches, a green leguminous crop late in the fall, when the moisture content is right, so that the upturned soil will crumble under the action of freezing and thawing, will improve the physical condition of this soil, will make possible a more thorough pulverization of the seed bed, and will increase the supply of available plant-food elements. A rotation that is recommended for increasing and maintaining the productiveness of this soil is corn and soy beans, soy beans, oats, and clover.

Mahoning silty clay loam, rolling phase.—The rolling phase of Mahoning silty clay loam is similar to typical Mahoning silty clay loam in color, structure, consistence, and texture of the soil material in the different soil horizons and layers. Its separation as a phase is based on its gently rolling or rolling relief.

Large areas of this soil extend back from the valleys of Grand and Chagrin Rivers and their principal tributaries. The surface run-off is fairly rapid, but the internal drainage is poor. The virgin tree growth consisted mainly of hard maple and beech.

The crops and methods of cultivation used on this soil are similar to those on the typical soil, and the suggestions offered for the improvement of typical Mahoning silty clay loam are applicable to this soil.

The following table gives the results of mechanical analyses of samples of different layers of the subsurface soil and subsoil of Mahoning silty clay loam:

Mechanical analysis of Mahoning silty clay loam

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
272731	Subsurface soil, 1 to 4 inches	0.7	2.4	1.4	7.0	9.6	58.6	20.3
272732	Subsurface soil, 4 to 6 inches	.8	1.8	1.3	7.7	11.6	56.0	21.2
272733	Subsurface soil, 6 to 8 inches	.6	1.7	.9	5.6	12.8	56.1	22.3
272734	Subsoil, 8 to 30 inches	1.0	1.4	.7	4.4	12.1	46.9	33.3
272735	Subsoil, 30 to 48 inches	.6	1.3	.8	5.2	11.4	47.5	32.6
272736	Subsoil, 48 to 60 inches	.9	1.3	.7	5.0	11.9	46.7	33.8

CANEADEA SILTY CLAY LOAM

The dry, virgin surface soil of Caneadea silty clay loam consists of dark-brown leaf mold grading, at a depth of about one-half inch, to dark olive-gray silt loam 1½ inches thick. This is underlain by gray or dark olive-gray heavy silt loam, mottled with yellowish brown and gray, or by light silty clay loam which gradually becomes lighter with increasing depth and rests, at a depth of about 6 inches, on a 12-inch layer of mottled light-gray and yellowish-brown silty clay containing some iron concretions. In many places there are seams of material which has fallen from the overlying layers into cracks which develop when the soil dries out. Between depths of 21 and 52 inches is plastic gray silty clay containing yellowish-brown mottles and iron concretions. The mottles in many places are of very fine sandy loam or loam texture. Below a depth of 52 inches is mottled gray and yellowish-brown laminated silty clay which contains some free lime (CO_2 from carbonates, 2.34 per cent in one sample).

There are many variations in the profile of Caneadea silty clay loam. In places a layer of fine or very fine sand occurs below a depth of 18 inches. There is in some places sufficient very fine sand or fine sand in the upper layers to cause the texture to approach loam. In most places where this soil is associated with Caneadea loam, Caneadea very fine sandy loam, and Caneadea fine sandy loam, or with Lorain silty clay loam there are numerous inclusions of these soils too small to be designated on the soil map. Many areas of this soil are dotted with small areas of Mahoning silty clay loam. West of Perry small areas of Allis silty clay loam are included in mapping. North of Perry and north of Indian Point the texture of the surface soil is clay loam, but because of the small area of this variation it has been mapped with Caneadea silty clay loam.

Determinations of the pH values of the various layers of the typical virgin soil gave the following results: 5.63 from 0 to one-half

inch, 5.65 from one-half to 2 inches, 5.58 from 2 to 6 inches, 6.43 from 6 to 20 inches, 6.78 from 20 to 52 inches, and 7.84 from 52 to 60 inches.

A large part—probably 90 per cent—of the Caneadea silty clay loam in Lake County is tilled. Cultivation has modified the virgin soil by mixing the surface layers. Other changes have been brought about through the application of commercial fertilizers and barnyard manure, by green manuring, and by tiling. To a depth of 8 inches the cultivated surface soil, under normal moisture conditions, consists of gray silty clay loam, but when the soil is wet the color becomes dark gray. This is a moderately productive soil and is easily tilled, but it has a rather small supply of organic matter.

Caneadea silty clay loam occurs between North and South Ridges and in the vicinities of Sunset Point and Madison Beach. The surface is flat. Drainage is slow, on account of the absence of slope and the compactness of the subsoil layers. Artificial drainage is rather difficult to establish.

The original timber growth was dense and consisted mainly of hard maple, tulip, and beech, with elm, soft maple, and black ash in the more poorly drained areas. Red and black oak, hickory, hemlock, basswood, cucumber, and sycamore were other important trees. Nursery stock, corn, mixed alsike or red clover and timothy, and oats, ranking in acreage in the order named, are the leading crops. Soy beans are planted alone or with corn. The average yield of corn is 43 bushels to the acre, of oats 45 bushels, of wheat 20 bushels, of soy beans 18 bushels, and of hay 1¼ tons.

Caneadea silty clay loam is only a fair soil, but with good methods of cultivation, such as are employed by the best farmers, the fertility can be increased and maintained. Most farmers practice a rotation consisting of corn for one year, succeeded by oats and sometimes wheat or rye seeded with a mixture of alsike and a little red clover and timothy. The stand of clover is usually light, and the crop is sometimes frozen out during the winter and early spring. Farmers usually cut the hay for one year, then in the fall apply barnyard manure to the sod land and plow it so that the freezing and thawing action will disintegrate and slake the soil, making it pulverulent and well suited for developing a good seed bed for corn in the spring. On some farms hay is cut for two or three years. Some farmers have introduced soy beans in the rotation, giving the succession of corn, soy beans, wheat, and hay consisting of alsike and medium red clover and timothy. On some of the larger nursery farms soy beans are the main soil-building crop and on others they are grown with corn and used for silage. When clover fails soy beans are sown at corn-planting time and are harvested for hay or seed in the fall. Commonly, land being prepared for nursery stock is plowed in the fall. One thousand pounds to the acre of ground limestone is applied with a limestone spreader and is harrowed in. The following May, after inoculation, soy beans are planted. These are plowed under in September, and the process, with the exception of the liming, is repeated. After plowing soy beans under the second time the soil is ready for seedling stock, such as peaches, apples, or pears. The fertilizer most commonly used is superphosphate (acid phosphate) which is commonly applied to oats and corn at the

rate of 200 pounds to the acre. Large quantities of stable manure are applied to the cornland.

Current land values range from $200 to $1,000 an acre, depending mainly on location for suburban development or residential sites.

The restoration and maintenance of the supply of readily decomposable organic matter by growing legumes, turning under green-manure crops, and applying stable manure is a very important step in the improvement of Caneadea silty clay loam. Tests for acidity indicate that the soil is in need of about 2 tons of pulverized limestone to the acre.

A rotation recommended for increasing and maintaining the productiveness of this soil, after liming, is corn or corn and soy beans, soy beans, oats, clover or corn, small grain, and sweet clover, the sweet clover being left for one year so that the roots will have time to penetrate downward and open up the heavy, plastic subsoil layers.

Farmers who have drained this soil state that properly laid tile drains, at current prices for labor and materials, will pay for themselves by increased crop production within eight years. As the land is level and the fall very slight in much of the area of Caneadea silty clay loam, it will be well to employ an experienced surveyor to determine the grades. Laterals placed at intervals of 40 feet and at a depth ranging from 30 to 36 inches have been found very satisfactory. Where tiling is not considered advisable at present, great care should be exercised in developing as thorough a system of surface drainage as is possible.

Caneadea silty clay loam, dark-colored phase.—The virgin surface soil of dry Caneadea silty clay loam, dark-colored phase, consists of a 1-inch layer of leaf litter and forest mold, grading to dark olive-gray silt loam which, at a depth of about 4 inches, grades to gray or dark-gray, finely granular silty clay loam. Below a depth of 6 inches is mottled light-gray and yellowish-brown finely granular silty clay loam which becomes heavier with increasing depth and grades, at a depth of about 8 inches, to a mottled light-gray, yellowish-brown, and brownish-yellow, finely granular, plastic silty clay layer which continues to a depth varying from 44 to 50 inches and rests on heavy, plastic clay, having a mottled light-gray, yellowish-brown, and brownish-yellow color.

About 50 per cent of the Caneadea silty clay loam, dark-colored phase, is tilled. Because of the mixing of the surface layers by plowing, and the modification of the structure and fertility by the application of stable manure and commercial fertilizers and by tiling, the cultivated soil, to a depth of 8 inches, consists of gray or dark-gray silty clay loam which when wet becomes decidedly dark gray. This soil has a fair supply of organic matter, is fertile, and is capable of being worked into a good seed bed. Great care should be exercised to work it when the moisture content is right for pulverization.

The chief areas of Caneadea silty clay loam, dark-colored phase, are in the northwestern part of the county, between North Ridge and Lake Erie. The surface of most of this soil is level but in a number of places where the land gradually rises from the stream channels it is gently sloping. Areas occur on slightly lower elevations than the

lighter-textured soils which it borders in most places. Natural drainage is very poor.

The virgin timber growth, the crops and their yields, the prevailing methods of management, and suggestions for improvement are practically the same as for typical Caneadea silty clay loam.

The following table gives the results of mechanical analyses of samples of the surface soil, subsurface soil, and different layers of the subsoil of Caneadea silty clay loam:

Mechanical analysis of Caneadea silty clay loam

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
272780	Surface soil, 0 to ½ inch	0.0	0.4	0.4	6.9	6.8	4.8	80.9
272781	Subsurface, ½ to 2 inches	.4	1.2	.8	3.6	7.6	50.0	36.8
272782	Subsurface, 2 to 6 inches	.3	1.4	.7	3.3	7.6	47.6	39.6
272783	Subsoil, 6 to 20 inches	.1	.7	.8	2.0	10.0	55.5	30.8
272784	Subsoil, 20 to 52 inches	.0	.3	.2	2.9	8.2	46.4	41.7
272785	Subsoil, 52 to 60 inches	.2	.6	.4	1.9	5.2	51.9	40.1

CANEADEA LOAM

The surface layer of dry virgin Caneadea loam to a depth of about 1 inch consists of a very dark grayish-brown or almost black mixture of very fine sand, leaf mold, and fine grass roots. Underlying this is grayish-brown, brownish-gray, or dark brownish-gray finely granular very fine loam which grades, at a depth of about 6 inches, to a 2-inch layer of granular brownish-gray very fine loam. Below this is a 4-inch layer of mottled light-gray, gray, brownish-yellow, and yellowish-brown finely granular very fine loam or very fine sandy loam in which the light-gray and gray granules are very fine loam and the brownish-yellow and yellowish-brown granules are very fine sandy loam. This grades to very fine sandy loam of variable color but generally brownish yellow mottled with gray. This material contains a few gravel and small iron concretions. Below a depth of 18 inches is a 6-inch layer of brownish-yellow very fine loam mottled with light gray and yellowish brown. The texture of the light-gray material is clay loam or very fine loam and that of the yellowish-brown material is very fine sandy loam. This layer grades to mottled light grayish-yellow, light yellowish-gray, yellowish-brown, and light-gray granular clay loam in which there are lines or streaks of iron oxide following old root courses. Between depths of 30 and 65 inches is mottled light-gray, brownish-yellow, and yellowish-brown granular silty clay which rests on light-gray silty clay mottled with brownish yellow and yellowish brown and containing a small quantity of lime.

This soil is characterized by many local textural variations which can not be shown on the map. The surface layers may vary in texture from very fine sandy loam or fine sandy loam to clay loam, and the mottled light-gray, brownish-yellow, and yellowish-brown granular silty clay layer may be reached at any depth between 10 and 40 inches. In the vicinity of Perry Park is an area, covering about 2 square miles, of a light-textured phase of loam or heavy very fine

sandy loam that has been included with this soil in mapping. Electrometric determinations of the pH values of the various layers of typical virgin soil of this type gave the following results: 5.27 from 0 to one-half inch, 5.03 from one-half to 6 inches, 5.38 from 6 to 8 inches, 5.61 from 8 to 12 inches, 6.13 from 12 to 18 inches, 6.46 from 18 to 24 inches, 6.76 from 24 to 30 inches, 7.25 from 30 to 65 inches, and 8.07 from 65 to 70 inches.

In this county about 50 per cent of the Caneadea loam is cultivated. The cultivated surface soil differs from the virgin, owing to an intermingling of the upper layers by plowing and to other modifications brought about through farm practices. In cultivated fields under normal moisture conditions the surface soil, to a depth of 8 inches, is brownish-gray very fine loam which becomes decidedly darker when wet. This soil is retentive of moisture and is comparatively easy to till, but it warms up rather slowly in the spring and is somewhat poorly supplied with organic matter.

Caneadea loam occurs in Willoughby, Mentor, Painesville, Perry, and Madison Townships in irregular areas and in long narrow belts which extend northeast and southwest, parallel with the shore line of Lake Erie. Areas are level and drainage is poor. However, the rather porous soil makes artificial drainage comparatively easy. Farmers report that where 4-inch tiles have been set at intervals of 2½ rods and at a depth between 30 and 36 inches, fair or good underdrainage has been accomplished.

The virgin tree growth consisted of hard maple, tulip, and beech with some red oak, black oak, hickory, basswood, hemlock, cucumber, and sycamore. White elm, bur oak, soft maple, and black ash grew in the low wet places. Nursery stock, truck crops, corn, mixed alsike clover and timothy and oats are the principal crops grown. Corn takes precedence in acreage. Dairying is carried on in conjunction with the production of the general farm crops. Soy beans are often grown with the corn and in a few fields are grown alone. Alfalfa and sweet clover are grown successfully by a few farmers. Corn yields from 40 to 50 bushels to the acre. Mixed alsike clover and timothy averages about 1 ton to the acre; oats, 45 bushels; wheat, 15 bushels; buckwheat, 18 bushels; soy beans, 15 bushels, and alfalfa, 2½ tons.

A rotation that is commonly followed on this soil consists of corn, oats, and mixed alsike clover and timothy. Most farmers cut hay for one year and the succeeding year use the field for pasture. Corn is often planted two years in succession. About 150 pounds of superphosphate (acid phosphate) is customarily applied to the cornland.

This land is currently valued at prices ranging from $200 to $1,000 an acre, depending on the suitability of the location for building sites.

On most farms more thorough drainage is needed. Although outlets are provided, many fields need tiling to hasten the removal of water, so that crops may be seeded early and cultivated regularly. This soil is poorly supplied with organic matter. This deficiency can be overcome by systematic green manuring, by growing legumes, and by the liberal use of barnyard manure or other actively decomposing manures. In decomposing, these materials furnish sufficient nitrogen and liberate other plant food, make the soil more retentive

of moisture during dry periods, and greatly improve the physical condition for the preparation of a good seed bed. Where the land has not been limed, 2 tons of finely ground limestone or 1 ton of air-slaked lime to the acre applied during the first rotation, and one-half ton of finely ground limestone or one-fourth ton of air-slaked lime during each subsequent rotation will aid greatly in establishing good stands of alsike and red clovers and soy beans. Alfalfa and sweet clover require a heavier application of lime. A rotation that would increase the productivity of this soil is corn, soy beans, oats or wheat, and sweet clover.

Caneadea loam, gravelly phase.—Dry virgin Caneadea loam, gravelly phase, consists of very dark grayish-brown gravelly loam underlain at a depth of about 2 inches by dark grayish-brown gravelly loam which grades at a depth of about 4 inches to a 6-inch layer of brownish-gray gravelly loam. This rests on a 4-inch layer of brownish-gray loam mottled with yellow, gray, and brown and containing considerable gravel. Between depths of 17 and 30 inches is brownish-yellow fine sandy loam, mottled with gray and light yellowish gray and containing more or less gravel and small iron concretions. Below this layer is mottled light yellowish-gray, light grayish-yellow, brownish-yellow, and yellowish-brown granular silty clay, which grades to mottled brownish-yellow and yellowish-brown silty clay containing a small quantity of lime.

About 90 per cent of the Caneadea loam, gravelly phase, is under cultivation. The cultivated surface soil differs in many respects from the virgin, owing to the mixing of the upper layers and the use of fertilizers. The cultivated soil under normal moisture conditions consists of an 8-inch layer of brownish-gray gravelly loam, but where the moisture content is decidedly above the average the color is dark brownish gray.

This soil occurs in small areas east of Willoughby, 2 miles northeast of Mentor, and in the vicinities of Lane and Perry. Areas are level and drainage is poor.

The original forest growth was practically the same as that on the typical soil. Nursery stock, truck crops, corn, mixed alsike or red clover and timothy, and oats are the principal crops. Corn yields about 43 bushels to the acre and oats 45 bushels. The suggestions offered for the improvement of typical Caneadea loam apply equally as well to this soil.

CANEADEA SILTY CLAY

In virgin areas of dry Caneadea silty clay the surface layer consists of a mixture of silt and partly decayed vegetable matter about 1 inch thick. This is underlain by dark olive-gray silty clay loam which grades, at a depth of about 4 inches, to finely granular, gray silty clay loam. This, in turn, grades, at a depth of about 6 inches, to light-gray finely granular silty clay mottled with yellowish brown. This, at a depth of about 12 inches, is underlain by mottled light-gray, yellowish-brown, and brownish-yellow finely granular plastic silty clay 20 inches thick. Between depths of 33 and 56 inches is a layer of gray finely granular, heavy, plastic silty clay mottled with yellowish brown, which rests on mottled gray and yellowish-brown,

plastic, laminated silty clay containing some lime. Between depths of 12 and 56 inches the soil material contains iron concretions.

About 75 per cent of the Caneadea silty clay is cultivated. The tilled soil differs from the virgin in that the surface layers have been mixed and other modifications have been brought about through cultivation. Under normal moisture conditions the soil, to a depth of 8 inches, is gray, heavy silty clay loam or light silty clay which when wet becomes dark gray. This soil has a fair supply of organic matter, but it is cold and must be cultivated within a narrow range of moisture conditions.

Caneadea silty clay occurs mainly between Fairport Harbor and McKinley Creek and in a small area south of Perry. The surface is level and drainage is very poor. The heavy, plastic soil layers impede the movement of ground water and make it difficult to accomplish successful drainage.

The original forest growth over most of this soil was of elm and soft maple. Black ash grew in the more poorly drained areas. Nursery stock, corn, mixed alsike or red clover and timothy, oats, and soy beans are the leading crops. Yields are practically the same as on Mahoning silty clay loam. The management of the soil, the selling price, and suggestions for improvement described for Caneadea silty clay loam apply equally as well to this soil.

Caneadea silty clay, dark-colored phase.—The virgin surface soil of dry Caneadea silty clay, dark-colored phase, consists of a 1-inch layer of organic matter and a mat of fine grass and partly decayed leaves and pieces of wood over dark olive-gray silty clay loam underlain at a depth of about 4 inches, by finely granular, dark olive-gray silty clay loam with a few faint yellowish-brown mottles. This, at a depth of about 6 inches, merges into light-gray finely granular silty clay mottled yellowish brown. Between depths of 10 and 20 inches is mottled light-gray, yellowish-brown, brownish-yellow, and light reddish-brown finely granular plastic silty clay. Beneath this is a 16-inch layer of mottled light-gray and yellowish-brown plastic finely granular silty clay which grades to mottled light-gray, yellowish-brown, and brownish-yellow plastic silty clay containing some lime (CO_2 from carbonates, 2.11 per cent in one sample).[4]

Probably 95 per cent of this soil is cultivated. The tilled surface soil differs from the virgin, owing to an intermingling of the upper layers by plowing, to some depletion of the supply of organic matter, as is indicated by the soil having become lighter in color under cultivation and to other modifications brought about through farm practices. In cultivated fields under normal moisture conditions the surface soil, to a depth of 8 inches, is gray or dark-gray, heavy silty clay loam. During wet periods the color is dark gray. Owing to the heaviness of this soil, cultivation is more difficult than on the prevailingly loamy-textured soils with which it is associated. This dark-colored soil is sticky when wet and clods on drying, and consequently must be worked when it is in a fairly moist condition.

Caneadea silty clay, dark-colored phase, occurs in large areas between North Ridge and Lake Erie in the northwestern part of the

[4] Determined from one sample by G. Edgington, U. S. Bureau of Chemistry and Soils.

county. It has a flat surface and lies a little below the general level of the surrounding country. The natural drainage is very poor.

The virgin forest growth, crops, yields, and methods of treatment for this soil are very similar to those for typical Caneadea silty clay.

Caneadea silty clay, dark-colored phase, is valued at prices ranging from $500 to $1,000 an acre, depending on its location for subdivision purposes.

Many fields of this soil are in need of tile drainage. After liming, sweet clover might be introduced in the crop rotation and left one year or for a sufficient time to allow the development of a root system that would penetrate downward into the heavy, plastic layers. This would greatly improve the internal circulation of water and air. Suggestions offered for the improvement of typical Caneadea silty clay apply to this soil.

Electrometric determinations of the pH values of the various layers of the virgin soil gave the following results: 6.05 from 0 to 4 inches, 5.87 from 4 to 6 inches, 5.90 from 6 to 10 inches, 5.88 from 10 to 20 inches, 6.09 from 20 to 36 inches, and 6.96 from 36 to 46 inches.

CANEADEA VERY FINE SANDY LOAM

In the virgin state, the surface layer of Caneadea very fine sandy loam consists of a very dark brownish-gray mixture of leaf mold and partly decayed wood and fine grass roots, grading at a depth of about 1 inch to a layer, 3 or 4 inches thick, of dark grayish-brown, mellow very fine sandy loam. This is underlain, to a depth of about 10 inches, by brownish-gray material with a platy structure which grades to light grayish-yellow platy very fine sand, mottled with grayish brown and brownish gray. This, at a depth ranging from 13 to 15 inches, grades to brownish-yellow very fine sandy loam with light-gray, brownish-yellow, yellowish-brown, and yellowish-gray mottles. Between depths of 15 and 60 inches is light yellowish-gray granular silty clay mottled with yellowish brown, brownish yellow, and yellowish gray. This rests on light grayish-yellow slightly calcareous silty clay. The layers above a depth of 10 inches are slightly acid and below that depth are neutral.

Electrometric determinations of the pH values of the various layers of a typical virgin area of this soil gave the following results: 5.55 from 0 to 2 inches, 5.94 from 2 to 5 inches, 6.36 from 5 to 10 inches, 6.50 from 10 to 13 inches, 6.58 from 13 to 15 inches, and 7.42 from 15 to 60 inches. Included in mapped areas of this soil are numerous small areas of Caneadea loam, Painesville very fine sandy loam, Painesville fine sandy loam, and Lorain very fine sandy loam. The depth of the silty clay layer is variable, ranging from 10 to 30 inches.

Approximately 40 per cent of the Caneadea very fine sandy loam is tilled. The cultivated soil differs from the virgin, owing to an intermingling of the upper layers by plowing and to other modifications brought about through farm practices. In cultivated fields under normal moisture conditions the soil, to a depth of 8 inches, is brown fine sandy loam which when wet becomes distinctly darker in

color. This soil is poor in organic matter, but with proper drainage is warm, early, and easy to cultivate.

Caneadea very fine sandy loam is fairly extensive in the extreme northern part of Lake County throughout the region lying between North Ridge and Lake Erie. Areas are prevailingly level. Drainage is poor, but artificial drainage can be readily established.

The virgin tree growth on this soil consisted principally of hard maple, basswood, tulip, beech, and hemlock. Corn, mixed alsike clover and timothy hay, oats, truck crops, and nursery stock are grown. Yields of corn average about 25 bushels to the acre; of hay, about three-fourths ton; of oats, 35 bushels; and of wheat, 12 bushels.

Farm lands of Caneadea very fine sandy loam currently sell for $200 to $1,000 an acre, depending mainly on the desirability of the location for residential purposes.

This soil is deficient in rapidly decomposing organic matter. The application of barnyard manure and the plowing under of green-manure crops, preferably legumes, will supply this constituent, improve the physical condition of the soil, and increase its productiveness. Recommendations made for Caneadea loam apply as well to this soil.

CANEADEA FINE SANDY LOAM

In virgin areas the surface material of Caneadea fine sandy loam consists of a 1-inch layer of forest mold and leaf litter, underlain by dark grayish-brown fine sand which, at a depth of about 4 or 5 inches, gives way to a 5-inch layer of brownish-gray fine sandy loam. Below this is light grayish-yellow fine sand, mottled yellow, gray, and brown, which grades, at a depth of about 19 inches, to a layer 30 or 40 inches thick of brownish-yellow fine sandy loam with yellowish-brown, brownish-yellow, yellowish-gray, and grayish-yellow mottles. This rests on light grayish-yellow, slightly calcareous, plastic silty clay. Where this soil is associated with Reynolds fine sandy loam, Painesville fine sandy loam, and Caneadea loam, there are numerous inclusions of these soils too small to designate on the map.

About 60 per cent of the Caneadea fine sandy loam is tilled. The virgin soil, when plowed and cultivated, is materially changed, owing to the intermingling of the surface layers and to the more rapid oxidation of the organic matter. Further changes are brought about by the application of barnyard manure, the plowing under of green crops, and the use of commercial fertilizers. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, is brownish-gray fine sandy loam, but when the moisture content exceeds normal the color is dark brown. This soil is early, warm, and easy to manage. The various soil layers are open, allowing free movement of air and water.

Except in Willoughby Township, this soil is well distributed throughout the region lying between the South Ridge and Lake Erie. The surface is flat and the natural drainage is poor, but artificial drainage is favored by the open character of the soil layer.

The virgin tree growth on this soil was of hard maple, basswood, tulip, beech, and hemlock, with some hickory, white ash, and red oak. In the low, wet plains bur oak, black ash, sycamore, and soft maple

grew. Practically the same crops are grown and similar yields are obtained on this soil as on Caneadea very fine sandy loam.

Caneadea fine sandy loam, light-textured phase.—In virgin areas, the surface soil of dry Caneadea fine sandy loam, light-textured phase, consists of a layer about one-half inch thick of a mixture of leaf mold, fine sand, and numerous fine grass roots, overlying dark grayish-brown loamy fine sand which becomes lighter in color with depth and which grades to a 4-inch layer of gray loamy fine sand at a depth of 4 inches. This is underlain by light grayish-yellow, or light yellowish-gray loamy fine sand, mottled yellow, gray, brownish gray, and grayish brown, which continues to a depth ranging from 50 to 60 inches and rests on light grayish-yellow, plastic, calcareous silty clay.

About 80 per cent of this soil is tilled. Because of the commingling of the surface layers by plowing, the more rapid oxidation of organic matter by cultivation, and the modification of structure and fertility by the application of stable manure and commercial fertilizers, the cultivated soil, to a depth of 8 inches, consists of gray loamy fine sand which becomes dark gray when wet. When drained this soil is warm and early.

Caneadea fine sandy loam, light-textured phase, occurs north and northeast of Heisley, in low, level, poorly drained areas. Where a satisfactory outlet can be obtained this soil can be drained easily because of the openness and porosity of the soil layers.

The virgin tree growth and the crops are about the same as those on Caneadea very fine sandy loam, but the yields are somewhat lower.

Adequate artificial drainage and the restoration and maintenance of the supply of rapidly decomposing organic matter by growing legumes, by the application of stable manure, and by turning under green-manure crops are very important steps in the improvement of this soil. According to tests for acidity this soil is in need of 2 tons of finely pulverized limestone to the acre.

CANEADEA SILT LOAM

The surface material of dry Caneadea silt loam in virgin areas consists of a ½-inch layer of very dark grayish-brown organic matter, underlain by a 2-inch layer of dark-gray silt loam. This is underlain by dark-gray silt loam, grading at a depth of about 4 inches to a 4-inch layer of gray silt loam faintly mottled with yellowish brown. Beneath this is mottled light-gray and yellowish-brown finely granular silty clay loam carrying a few iron concretions and continuing to a depth of about 20 inches. Beneath this is a 30-inch layer of finely granular gray silty clay mottled with yellowish brown and containing iron concretions. Below this layer is mottled gray and yellowish-brown laminated silty clay containing some lime. In many places layers of fine sand, very fine sand, fine sandy loam, very fine sandy loam, loam, and silt loam are interstratified with the silty clay loam at varying depths below 12 inches. Included with this soil, as mapped, are small areas of Caneadea silty clay loam, Caneadea loam, Caneadea very fine sandy loam, Caneadea fine sandy loam, Lorain silt loam, and Lorain silty clay loam.

About 80 per cent of the Caneadea silt loam is cultivated. Modifications brought about through the mixing of the surface layers and other changes resulting from tillage cause the cultivated soil to differ from the virgin. Under normal moisture conditions the tilled soil to a depth of 8 inches consists of gray silt loam. When the moisture content is above normal the color is dark gray. This soil is retentive of moisture and is comparatively easy to till, but it warms up rather slowly in the spring.

Caneadea silt loam is fairly well distributed throughout the region lying between South Ridge and Lake Erie. Areas are level. Drainage is slow, and artificial drainage is rather hard to establish.

The virgin timber growth consisted mainly of hard maple, beech, and tulip, with soft maple, elm, and black ash in the wetter places. The crops, yields, and suggestions for improvement are much the same as for Caneadea silty clay loam.

CHENANGO GRAVELLY FINE SANDY LOAM, BEACH-RIDGE PHASE

The dry surface material of Chenango gravelly fine sandy loam, beach-ridge phase, consists of very dark grayish-brown gravelly fine sandy loam, which grades, at a depth of 2 inches, to a lighter-colored layer. At a depth of 3½ inches this is underlain by dark grayish-brown gravelly fine sandy loam which continues to a depth of 5 inches and is underlain by loamy brown gravelly fine sand. This, at a depth of about 12 inches, rests on light grayish-yellow loamy fine sand which continues to a depth of about 42 inches where a layer, from 4 to 8 inches thick, of brown, small, rounded gravel occurs. Below this is a layer, from 2 to 6 inches thick, of brown coarse sand which grades at a depth of about 52 inches to rounded gravel consisting of sandstone, shale, and a small percentage of crystallines, all covered more or less with a coating of lime. Below a depth varying from 5 to 10 inches the material is stratified. Included with mapped areas of Chenango gravelly fine sandy loam, beach-ridge phase, are numerous small areas of the beach-ridge phases of Chenango loam and Chenango fine sandy loam.

Electrometric determinations of the pH values of the various layers in the virgin soil gave the following results: 5.31 from 0 to 2 inches, 5.35 from 2 to 3½ inches, 5.27 from 3½ to 5 inches, 5.63 from 5 to 12 inches, 5.82 from 12 to 42 inches, 6.76 from 42 to 48 inches, 5.98 from 48 to 52 inches, and 8.03 from 52 to 60 inches.

Probably 95 per cent of this soil is cultivated. Modifications brought about through the mixing of the surface layers, the depletion of the supply of organic matter, indicated by the soil becoming lighter in color since it was first broken, and other changes resulting from tillage cause the cultivated soil to differ from the virgin. Under normal moisture conditions the tilled soil, to a depth of 8 inches, consists of dark grayish-brown gravelly fine sandy loam. When the moisture content is above normal the color is darker. This is a warm, early soil well suited to the production of early vegetables, potatoes, grapes, peaches, berries, nursery stock, and general farm crops.

This soil occurs on North and South Ridges and on other ridges extending parallel to the shore of Lake Erie in the northern part of

the county. The surface is generally level, but along the escarpments the land is sloping. Drainage is good.

The virgin timber growth consisted of hard maple, black walnut, butternut, tulip, basswood, beech, hickory, and chestnut.

Nursery stock, corn, mixed red clover and timothy hay, oats, grapes, peaches, and berries are the leading crops. Soy beans are sometimes planted alone or with the corn. Other crops are tomatoes, cucumbers, cabbage, beets, carrots, parsnips, squash, peppers, lettuce, currants, apples, pears, plums, and cherries.

On this soil corn yields range from 20 to 70 bushels to the acre, with about 37 bushels as an average. Mixed red clover and timothy hay average about 1 ton to the acre; oats, 45 bushels; wheat, 16 bushels; and alfalfa, 2½ tons.

In managing this soil the practices are about the same as those described for Caneadea silty clay loam.

Current land values range from $500 to $2,000 an acre, depending on the desirability of the location for residential sites.

Chenango gravelly fine sandy loam, beach-ridge phase, is poorly supplied with organic matter, and this deficiency, together with the openness of the soil, allows a ready leaching of soluble mineral plant foods. Where readily decomposable organic matter is supplied, the moisture-holding capacity of the soil is increased and leaching is decreased, and the soil is better fitted to nourish crops during the dry periods of summer.

CHENANGO GRAVELLY LOAM

The surface soil of dry, virgin Chenango gravelly loam consists of about a 1-inch layer of leaf mold mixed with sand and gravel, underlain by dark grayish-brown gravelly loam which, at a depth of about 5 inches, grades to brown gravelly loam 5 or 6 inches thick. Below this the material is yellowish-brown heavy gravelly loam which, at a depth of about 10 inches, grades to mottled brown, yellowish-brown, and gray gravelly loam. This continues to a depth ranging from 15 to 36 inches and is underlain by stratified beds of gravel and sand. These beds are calcareous at a depth varying from 48 to 56 inches. The lime occurs chiefly as a coating on the gravel.

About 95 per cent of the Chenango gravelly loam is tilled. Owing to modifications brought about by the mixing of the upper layers the tilled soil differs from the virgin soil. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, consists of brown, friable, mellow gravelly loam which when wet becomes dark brown in color.

Chenango gravelly loam occurs along Kellogg Creek valley. The surface ranges from level to sloping, and the drainage is good.

The virgin tree growth on this soil was similar to that on Chenango loam. The crops grown, yields obtained, and farm practices are very similar to those on Chenango loam. Recommendations suggested for Chenango gravelly fine sandy loam, beach-ridge phase, could be followed in managing Chenango gravelly loam.

Chenango gravelly loam, beach-ridge phase.—The dry surface material or virgin Chenango gravelly loam, beach-ridge phase, consists of very dark grayish-brown, heavy gravelly loam which grades in color to dark grayish brown at a depth of about 2½ inches and

to brown at a depth of about 5 inches. Below this depth the material is gravelly fine sandy loam underlain, at a depth of about 10 inches, by light grayish-yellow gravelly fine sandy loam which, at a depth of about 40 inches, grades to stratified beds of sand and gravel. These, below a depth of about 50 inches, are calcareous, the lime occurring chiefly as a coating on the gravel. A common variation occurs in areas where stratified beds of sand and gravel are within 20 or 30 inches of the surface. As mapped, small areas of Chenango gravelly fine sandy loam, beach-ridge phase, are included with this soil.

About 98 per cent of the Chenango gravelly loam, beach-ridge phase, is cultivated. The tilled soil differs from the virgin in that the surface layers have been mixed together, the supply of organic matter has been more or less depleted, barnyard manure and commercial fertilizers have been applied, and green-manure crops have been plowed under. Under normal moisture conditions the tilled soil, to a depth of 8 inches, is dark grayish-brown loam which becomes darker when wet. Chenango gravelly loam, beach-ridge phase, is a warm, early, and productive soil.

Chenango gravelly loam, beach-ridge phase, occurs along North and South Ridges and near Salida. The surface is nearly level or gently sloping, and the drainage is good.

The tree growth, crops, yields, and requirements of this soil are much like those on Chenango gravelly fine sandy loam, beach-ridge phase.

CHENANGO LOAM

The top layer of dry, virgin Chenango loam consists of leaf mold and humus soil about 1 inch thick. Below this is a 4-inch layer of friable, dark grayish-brown loam which grades to brown loam. This, at a depth of about 10 or 12 inches, grades to yellowish-brown heavy loam or light, friable clay loam which, at a depth varying from 18 to 36 inches, rests on stratified beds of gravel and sand which are calcareous at a depth ranging from 48 to 60 inches, the lime occurring chiefly as a coating on the gravel. All the layers of this soil contain some gravel.

Included in mapped areas of this soil are areas of Chenango silt loam near the junction of Kellogg and Ellison Creeks and along East Branch Chagrin River. In these areas, the dry virgin soil consists of a 1-inch layer of leaf mold, underlain by friable, dark grayish-brown or dark-brown silt loam which, at a depth of about 5 inches, grades to brown, friable silt loam. This continues to a depth of about 10 inches, where it grades to yellowish-brown heavy silt loam or light friable silty clay loam. This layer is from 10 to 15 inches thick and grades to brownish-yellow loam which, at a depth varying from about 36 to 44 inches, rests on stratified beds of sand and gravel. Below a depth varying from 48 to 60 inches the material is slightly calcareous.

About 95 per cent of the Chenango loam is cultivated. The tilled surface soil differs from the virgin, owing to a mixing of the upper layers by plowing and to other modifications brought about through farm practices. Under normal moisture conditions the tilled soil, to a depth of 8 inches, is brown, mellow, friable loam, which when

wet appears dark brown. This soil is warm, early, and easily managed but is somewhat poorly supplied with organic matter.

Chenango loam occurs principally in level areas from 120 to 140 feet above the present stream flood plains, between Chagrin River and East Branch Chagrin River, and along Chagrin River, Kellogg Creek, and Big Creek valleys. The topographic position of the soil, together with its gravelly substratum, affords excellent drainage.

The virgin timber growth consisted of hard maple, chestnut, black walnut, tulip, red oak, basswood, beech, and hickory. Corn, oats, mixed clover and timothy, and potatoes are grown. The yields of corn average 45 bushels to the acre, of oats 45 bushels, of mixed red clover and timothy hay 1¼ tons, and of potatoes 125 bushels.

This soil is commonly farmed in conjunction with Mahoning silty clay loam. Suggestions offered for the improvement of Chenango gravelly fine sandy loam, beach-ridge phase, are also applicable to this soil.

CHENANGO GRAVELLY FINE SAND, BEACH-RIDGE PHASE

In virgin areas of Chenango gravelly fine sand, beach-ridge phase, the dry surface material consists of very dark grayish-brown gravelly fine sand, rich in organic matter, which at a depth of about 2 inches is underlain by dark grayish-brown gravelly fine sand. At a depth of about 4 inches this grades to brown gravelly fine sand which continues to a depth of about 10 inches, where a 30-inch layer of light grayish-yellow fine sand occurs. Below this are stratified beds of gravel and sand, which are slightly calcareous between depths of 50 and 60 inches. In these beds the lime occurs generally as an incrustation on the coarse material.

About 95 per cent of the Chenango gravelly fine sand, beach-ridge phase, is under cultivation. The tilled soil differs from the virgin in that there has been a mixing of the surface layers and other changes developed through the use of manure and commercial fertilizers. Under normal moisture conditions the cultivated soil, to a depth of 7 inches, consists of brown gravelly fine sand. When the soil is wet the color is dark brown or dark grayish brown. This soil contains a fair supply of organic matter, is fairly retentive of moisture, warms up early in the spring, and is easy to manage.

Areas of Chenango gravelly fine sand, beach-ridge phase, occur along North Ridge northeast of Painesville, in the vicinity of North Madison, and in other low ridges near Salida. Areas are in general level or undulating but in places are ridgy. Drainage is good or excessive.

The virgin timber growth and the crops grown are about the same as those described for Chenango gravelly fine sandy loam, beach-ridge phase, but the yields are somewhat smaller. The suggestions offered for the improvement of Chenango gravelly fine sandy loam, beach-ridge phase, are applicable to this soil.

CHENANGO VERY FINE SANDY LOAM

The dry surface soil of virgin Chenango very fine sandy loam consists of a 2-inch layer of very dark grayish-brown very fine sandy loam, containing a high percentage of organic matter. Below

this the color is very dark brown, but with increasing depth it becomes dark brownish gray. Between depths of 6 and 13 inches is a layer of loamy very fine sand, which at greater depths has a light grayish-yellow color. This continues to a depth of 50 or 60 inches, where beds of fine gravel and coarse sand occur. This soil, as mapped about one-half mile southwest of Pleasant Valley, includes small areas of Chenango gravelly fine sandy loam, and as mapped 2 miles south of Willoughby includes a rolling phase of Chenango very fine sandy loam. About one-half mile northeast of Pleasant Valley, a small area of Chenango fine sand is included, and one-half mile southeast of Willoughby an area of very fine sandy loam or loam underlain by shale at a depth of 2 feet is mapped with this soil.

Chenango very fine sandy loam is very inextensive. It occurs southeast of Willoughby on level surfaces. It is well drained.

Dairying is the leading type of agriculture practiced on this soil. The yields of crops are comparable to those obtained on Chenango gravelly loam.

BERRIEN VERY FINE SAND

The virgin surface material of Berrien very fine sand, when dry, consists of a layer, about one-half inch thick, of a very dark grayish-brown mixture of vegetable mold, very fine sand, silt, fine grass roots, and dry leaf litter. Beneath this is dark grayish-brown loamy fine sand which grades at a depth of about 3 inches to brown, loamy very fine sand. This grades at a depth of about 11 inches to yellowish-brown very fine sand underlain at a depth of about 24 inches by a 30-inch layer of light yellowish-brown very fine sand. This material rests on brown fine sandy loam which becomes heavier with increasing depth and grades to slightly calcareous silty clay at a depth varying from 60 to 70 inches. In places iron concretions occur in all the layers below a depth of 11 inches, and in other places stratified beds of fine sand, medium sand, and gravel are present below a depth of 18 inches. Included in mapped areas of this soil are many small areas of Caneadea very fine sand and very fine sandy loam and of Lorain very fine sandy loam.

Electrometric determinations of the pH values of the different layers of a typical area of virgin soil gave the following results: 4.06 from 0 to 2 inches, 5.39 from 2 to 5 inches, 5.20 from 5 to 15 inches, 5.04 from 15 to 26 inches, 5.47 from 26 to 56 inches, 7.07 from 56 to 63 inches, and 8.27 from 63 to 70 inches.

About 30 per cent of the Berrien very fine sand is under cultivation. The more important differences between the cultivated and virgin soils are the mixing of the surface layers through plowing and cultivation, and the decrease of the virgin humus, as is indicated by the soil becoming lighter in color since it was first broken. Under normal moisture conditions the cultivated soil to a depth of 8 inches consists of brown loamy very fine sand. When the moisture content exceeds normal the color ranges from brown to dark brown. This soil is rather poor in organic matter, is fairly retentive of moisture, warms up early in the spring, and is comparatively easy to till.

The principal occurrence of this soil is in the northeast corner of the county. Small areas are north and northeast of Painesville.

The surface is level but near Lake Erie is somewhat cut by stream gullies and small, narrow valleys. Drainage is well established.

The virgin tree growth consisted of hard maple, chestnut, tulip, birch, hickory, hemlock, black walnut, butternut, and basswood. The principal crops are corn, mixed clover and timothy hay, oats, truck crops, and some grapes, peaches, apples, and berries. Corn yields about 25 bushels to the acre, hay about three-fourths ton, oats 35 bushels, and wheat 12 bushels.

In the treatment of this soil, sod is usually covered with stable manure and broken for corn, which is succeeded by oats. Then the ground is seeded to clover and timothy. This system is varied somewhat to meet individual needs. Sometimes potatoes or other truck crops take the place of corn, and sometimes wheat, rye, or soy beans take the place of oats. About 200 pounds to the acre of superphosphate (acid phosphate) is applied to corn and 400 pounds to potatoes.

Berrien very fine sand has a current value ranging from $200 to $2,000 an acre, depending mainly on its location for residential sites.

The limiting factors in crop production on this soil are low water supply, low fertility, and low supply of actively decomposing organic matter. The improvement of the soil must be based on increasing the quantity of organic matter, which will not only increase the water-holding capacity and fertility but will also tend to prevent blowing. This can best be done by growing legumes and plowing under green-manure crops. If the land has not been previously limed, from 2 to 3 tons of finely pulverized limestone to the acre will aid in obtaining a good stand of clover. Manure can be used to best advantage on cornland. Where the soil is very light textured a winter crop of rye and vetch will prevent blowing.

BERRIEN FINE SAND

Virgin Berrien fine sand, when dry, has a ½-inch surface layer of a very dark grayish-brown mixture of leaf mold, fine sand, silt, fine grass roots, and partly decayed leaves, underlain by dark grayish-brown fine sand which grades, at a depth of about 2½ inches, to grayish-brown fine sand, which in turn, at a depth of about 4 inches, grades to a 5-inch layer of brown fine sand. Below this is yellowish-brown fine sand underlain at a depth of about 30 inches by a 25-inch layer of light yellowish-brown fine sand. In the lower part of this layer the material becomes loamy and rests on brown fine sandy loam which grades, at a depth of about 60 inches, to calcareous silty clay. In many places the yellowish-brown fine sand extends from a depth of 9 inches to 50 or 60 inches and grades to a layer, from 3 to 6 inches thick, of gravelly fine sandy loam which rests on stratified beds of slightly calcareous gravel.

About 95 per cent of the Berrien fine sand is tilled. Cultivation has modified the virgin soil by mixing the surface layers and by causing a more rapid decomposition of the virgin humus. Other changes have been brought about through the application of commercial fertilizers and barnyard manure and by growing green-manure crops. The cultivated soil, under normal moisture condi-

tions, consists of a 7-inch layer of brown fine sand, which when wet ranges from brown to dark brown. This soil is poor in organic matter but is warm, early, and easy to manage when under cultivation.

Berrien fine sand occurs principally south of North Ridge in Madison Township. A smaller area is 2 miles west of Painesville. Areas are undulating or gently rolling, and the drainage is good.

The virgin tree growth on Berrien fine sand consisted of tulip, hard maple, chestnut, pine, hemlock, beech, red oak, black oak, black walnut, butternut, and cucumber. The principal crops grown are corn, mixed clover and timothy hay, oats, truck crops, peaches, apples, berries, and nursery stock. Suggestions offered for the improvement of Berrien very fine sand are suitable for this soil.

Berrien fine sand, beach-ridge phase.—In dry virgin soil of the beach-ridge phase of Berrien fine sand a one-half inch layer of fine sand mixed with leaf litter and leaf mold grades to loose, dark grayish-brown fine sand underlain, at a depth of about 2 inches, by an 8-inch layer of somewhat incoherent brown fine sand, beneath which is yellowish-brown fine sand. At a depth of about 50 inches this material grades to brown fine sand which rests, at a depth of about 60 inches, on a bed of slightly calcareous gravel. In places the material, at a depth of 50 inches, is brown fine sandy loam and at a depth of about 60 inches is slightly calcareous silty clay.

Probably 95 per cent of this soil is cultivated. The cultivated soil differs from the virgin in that there has been a mixing of the upper layers through plowing. Much of the cultivated soil being lighter in color than when it was first broken indicates depletion of the supply of organic matter. The tilled soil, to a depth of 7 inches, is brown fine sand. The soil is warm and early.

The virgin tree growth was about the same as on typical Berrien fine sand. The methods of cultivation employed, the crops, yields, and the suggestions made for the improvement of this phase of soil are about the same as for the typical soil.

MENTOR SILT LOAM

The virgin surface layer of dry Mentor silt loam to a depth of one-half or 1 inch, consists of leaf mold mixed with sand and silt. It is underlain by friable, dark grayish-brown silt loam which, at a depth of about 5 inches, grades to a 5-inch layer of brown, friable silt loam. Between depths of 11 and 24 inches is yellowish-brown, friable silty clay loam which grades to brownish-yellow loam, slightly calcareous at a depth varying from 48 to 60 inches.

In many places the entire soil is lighter in texture than typical, and in these areas the subsoil layers may be loam or fine sandy loam. In other places the soil is heavier than typical and the subsoil layers are predominantly silty clay loam or silty clay and in most places, below a depth of 3 inches, have grayish-brown, yellowish-brown, and brownish-yellow mottles. Many small areas of Chenango silt loam, of Mentor loam, and of Mentor silty clay loam are included with this soil as mapped.

About 95 per cent of the Mentor silt loam is cultivated. Modifications brought about through the mixing of the surface layers and other changes resulting from tillage cause the cultivated soil to differ from the virgin. Under normal moisture conditions, to a depth of 8 inches, the material consists of brown, friable, mellow silt loam, but when the moisture content is above normal the color is darker. This is a warm, early, fertile soil which can easily be worked into a splendid seed bed. It has a fair supply of organic matter and has good moisture-holding capacity, so that crops rarely suffer seriously from lack or excess of moisture.

Mentor silt loam occurs mainly in Perry and Madison Townships in areas that border the top of the south bluff of Grand River. Smaller areas border the tops of the bluffs of the valleys of Chagrin River, East Branch Chagrin River, Paine Creek, Big Creek, and Kellogg Creek, and also occur in the terraces of these streams. Areas are usually level or gently sloping, but some of the areas are more or less dissected by deep narrow ravines. The drainage is good.

The trees on areas of virgin Mentor silt loam were chestnut, red oak, tulip, hard maple, basswood, beech, hemlock, and hickory. Nursery stock, truck crops, berries, corn, red clover, timothy, and oats are grown on this soil. Corn yields about 45 bushels to the acre, hay 1¼ tons, and oats 45 bushels.

A rotation including corn, oats, and mixed red clover and timothy is followed. Potatoes sometimes take the place of corn. An application of 150 pounds of superphosphate (acid phosphate) is usually made for corn and oats.

The same methods of improvement are needed for this soil as have been described for Chenango gravelly fine sandy loam, beach-ridge phase.

Mentor silt loam, mottled-subsoil phase.—Dry virgin Mentor silt loam, mottled-subsoil phase, has a thin surface layer of vegetal mold underlain by a 4-inch or 5-inch layer of friable, dark grayish-brown silt loam which grades to brown or grayish-brown friable silt loam. This, at a depth of 10 or 12 inches, rests on yellowish-brown, friable, light silty clay loam which, at a depth varying from 18 to 24 inches, grades to brownish-yellow friable silt loam with grayish-yellow, yellowish-gray, and yellowish-brown mottles which become more pronounced with increasing depth. At a depth ranging from 50 to 60 inches the material in places is slightly calcareous.

Included with mapped areas of Mentor silt loam, mottled-subsoil phase, are small areas of Tyler silt loam and of Mentor silt loam and Mentor loam. In some places the material below a depth of 15 or 20 inches has a loam texture. About 1 mile east of Kirtland and north of East Branch Chagrin River the soil is very dark grayish-brown silt loam grading at a depth of 4 inches to dark grayish-brown silt loam, which at a depth of 10 or 12 inches rests on brown silt loam. This, at a depth of 15 inches, is underlain by yellowish-brown silt loam which becomes brownish yellow at a depth of about 30 inches.

About 95 per cent of the Mentor silt loam, mottled-subsoil phase, is tilled. The virgin soil, when plowed and cultivated, is very materially changed, owing to the intermingling of the surface layers, to the more rapid oxidation of the organic matter, and to the

depletion of the plant-food elements. Under normal moisture conditions the cultivated soil at a depth of 8 inches is grayish-brown or brown friable mellow silt loam, but when wet the color becomes dark grayish brown. The soil is early, warm, has a fair content of organic matter, and is easy to manage.

This soil occurs on the terraces along Chagrin River, East Branch Chagrin River, Grand River, and Big Creek. The surface is level or gently sloping to the stream courses, and the drainage is fairly good.

The virgin forests on this soil supported a growth of chestnut, hard maple, red oak, tulip, basswood, hickory, hemlock, black walnut, and butternut. Corn, oats, and mixed clover and timothy hay are the principal crops. Corn yields about 45 bushels to the acre, oats 45 bushels, and mixed clover and timothy hay 1¼ tons.

A rotation consisting of corn, soy beans, oats, and red clover is suggested for this soil.

MENTOR LOAM

In dry virgin Mentor loam a thin covering of forest mold, leaf litter, and humus soil is underlain by a 4-inch layer of friable, dark grayish-brown loam which rests on brown loam. This, at a depth of about 10 or 11 inches, grades to yellowish-brown, heavy loam or very light, friable clay loam which, at a depth varying from 18 to 26 inches, grades to brownish-yellow loam or fine sandy loam. Similar material continues to a depth of 50 or 60 inches and is underlain by heavy-textured material containing some lime.

This soil is characterized by many local textural variations which it is impossible to separate on the map. The material below a depth of 20 inches may vary from loamy fine sand to clay loam. There are many inclusions of Mentor silt loam and Mentor fine sandy loam, of Chenango loam, and of Mentor loam, mottled-subsoil phase.

Mentor loam occurs in small areas on the low terraces of Big Creek, southeast of Painesville. About 95 per cent of the Mentor loam is tilled. The cultivated soil differs from the virgin, owing to the mixing of the surface layers and to other modifications that have developed through cultivation. The cultivated soil, under normal moisture conditions, consists of brown loam which when wet becomes dark brown in color. This soil is warm, early, and productive. Drainage is good.

The original forest growth consisted of chestnut, red oak, tulip, hard maple, basswood, beech, hemlock, and hickory. Corn, oats, and hay are the main crops. The average yield of corn is about 45 bushels to the acre, of oats 45 bushels, and of mixed clover and timothy hay 1¼ tons. Improvements in methods along the lines suggested for Chenango gravelly fine sandy loam, beach-ridge phase, are applicable to this soil.

PAINESVILLE VERY FINE SANDY LOAM

The dry surface soil of virgin Painesville very fine sandy loam, to a depth of 1½ inches, consists of a very dark brown mixture of partly decayed roots, twigs, and leaves with some very fine sand. This rests on a dark grayish-brown loamy fine sand or light very fine

sandy loam, which grades, at a depth of about 6 inches, to yellowish-brown loamy very fine sand. Below a depth of about 8 inches is light yellowish-gray very fine sand which, at a depth varying from 18 to 22 inches, grades abruptly to compact, light grayish-yellow, or light yellowish-gray silty clay or silty clay loam, mottled with brownish yellow and yellowish brown. This layer has a granular structure, contains some pebbles, and rests on slightly calcareous, granular, very light grayish-yellow or brownish-yellow silty clay with yellowish-brown and brownish-yellow mottles. This soil, as mapped, includes many patches of Caneadea very fine sandy loam and some of Painesville very fine sand. In places the upper layers, to a depth varying from 6 to 10 inches, consist of light very fine sandy loam underlain by very fine sand.

Electrometric determinations of the pH values for the various layers of the typical virgin soil gave 4.62 from 0 to 2 inches, 5.12 from 2 to 6 inches, 5.55 from 6 to 8 inches, 5.94 from 8 to 20 inches, and 7.32 from 20 to 61 inches.

About 50 per cent of the Painesville very fine sandy loam is tilled. The virgin soil, when plowed and cultivated, is materially changed, owing to the intermingling of the surface layers, to the more rapid oxidation of the organic matter, and to the depletion of other plant-food elements. Further changes are brought about by the application of manure, by plowing under green crops, and by the use of commercial fertilizers. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, is brown very fine sandy loam, but when the moisture conditions exceed normal the color is darker. This soil is early and is easy to manage.

Painesville very fine sandy loam occurs between North Ridge and Lake Erie in all the townships that border Lake Erie. The surface is level, and the drainage is good.

Uncleared areas of this soil supported a forest growth similar to that on Painesville fine sandy loam. The character of the crops and the yields are practically the same as on Chenango gravelly fine sandy loam, beach-ridge phase.

Painesville very fine sandy loam could be improved by the more frequent plowing under of leguminous crops. Moderate applications of lime will prove beneficial in connection with such crops as clover and alfalfa. Suggestions offered for the improvement of Berrien very fine sand apply to this soil.

PAINESVILLE FINE SANDY LOAM

The dry, virgin surface soil of Painesville fine sandy loam consists of a mixture of fine sand, leaf mold, and leaf litter. This grades, at a depth of about 1½ inches, to dark grayish-brown or brown loamy fine sand or light fine sandy loam which, at a depth of about 4½ inches, is underlain by a 4-inch layer of yellowish-brown loamy fine sand or light fine sandy loam. This in turn is underlain by light grayish-yellow fine sand or loamy fine sand which grades, at a depth ranging from 15 to 40 inches, to gray, laminated silty clay mottled with brownish yellow, yellowish brown, and yellowish gray. This material is slightly calcareous at a depth ranging from 55 to 65 inches. In many places the clay is not laminated

but contains crystalline pebbles and some shale fragments. In some places stratified beds of gravel and sand containing lenses of silt and clay occur within a depth varying from 15 to 30 inches from the surface. As mapped, small areas of Painesville very fine sandy loam, Painesville loam, and Painesville fine sand are included with this soil.

Probably 75 per cent of the Painesville fine sandy loam is cultivated. The cultivated soil differs from the virgin in that cultivation has mixed together the surface layers. The tilled soil, to a depth of 8 inches, consists of brown loamy fine sand or light fine sandy loam which becomes darker in color when wet. This soil is rather poorly supplied with organic matter, is fairly retentive of moisture, warms up early in the spring, and is comparatively easy to till.

Painesville fine sandy loam occurs mainly between North and South Ridges northwest of Madison and south of Painesville. Smaller areas are southwest of Willoughby and east of Painesville. The surface is level or undulating, and drainage is good.

The virgin forest on this soil was principally of hard maple, black walnut, butternut, and tulip, with some basswood, beech, hickory, cucumber, and hemlock.

The crops, yields, farm practices, and suggestions for improvement are about the same as those given for Chenango gravelly fine sandy loam, beach-ridge phase.

PAINESVILLE SILT LOAM

The surface material of Painesville silt loam consists of a layer about 1 inch thick of organic matter consisting of partly decayed leaves and a mat of fine grass roots. This is underlain by a 4-inch layer of dark grayish-brown friable silt loam, which, in turn, is underlain by grayish-brown friable silt loam grading at a depth of about 8 inches, to yellowish-brown heavy silt loam which with increasing depth gradually becomes brownish yellow. Below a depth varying from 12 to 20 inches the material is light grayish-yellow loam or fine or very fine sandy loam underlain by gray silty clay with yellowish-brown and brownish-yellow mottles.

North of Indian Point and east of Painesville are areas of Painesville loam which, owing to their small total extent, have been mapped with Painesville silt loam. This soil differs from Painesville silt loam chiefly in the lighter or more loamy texture of the surface soil.

About 95 per cent of the Painesville silt loam is tilled. Modifications in the virgin soil have been brought about by the mixing of the upper layers. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, consists of grayish-brown loam which when wet becomes dark grayish brown in color. This is a warm, early, and fertile soil.

This soil occurs between North and South Ridges between Perry and Painesville. The surface is level, and the drainage is good.

The virgin tree growth consisted of hard maple, chestnut, red oak, tulip, basswood, hemlock, hickory, beech, black walnut, and butternut. Nursery stock, truck crops, berries, corn, red clover, timothy, and oats are produced on this soil. Corn yields about 45 bushels to

the acre, oats 45 bushels, mixed red clover and timothy hay 1¼ tons, and potatoes 125 bushels.

Suggestions offered for the improvement of Chenango gravelly fine sandy loam, beach-ridge phase, are applicable to this soil.

LORAIN SILTY CLAY LOAM

The upper soil layers of dry Lorain silty clay loam consist of grayish-black or brownish-black leaf mold, grading at a depth of about 1 inch to very dark grayish-brown or very dark brownish-gray silt loam which is underlain at a depth of about 4 inches by a layer of dark grayish-brown or dark brownish-gray mellow silty clay loam. At a depth of about 9 inches this rests on gray, mottled yellowish-brown and brownish-yellow finely granular silty clay loam which becomes heavier with increasing depth and grades, at a depth of about 16 inches, to silty clay. This layer continues to a depth ranging from 47 to 60 inches, where mottled gray and yellowish-brown slightly calcareous silty clay occurs.

Between Wickliffe and Willoughby and northeast of Perry are a number of areas of Lorain clay loam which, owing to their small total area, have been included with this soil in mapping.

Approximately 95 per cent of this soil is cultivated. The tilled soil differs from the virgin, owing to the addition of soluble elements by the application of barnyard manure and commercial fertilizers. Under normal moisture conditions the tilled soil, to a depth of 8 inches, is dark grayish-brown or dark brownish-gray mellow silt loam which when wet is very dark grayish brown or very dark brownish gray. This soil is well supplied with organic matter and if properly drained is very productive.

Lorain silty clay loam is mostly in the vicinities of Perry and Painesville. The surface is level and the drainage is poor. Owing to the absence of slope and the compactness of the subsoil layers, artificial drainage is rather difficult.

On this soil the virgin tree growth was of white elm, bur oak, swamp white oak, black ash, and sycamore.

On some farms adequate provision for maintaining the supply of readily decomposing organic matter in the soil has not been made and productiveness is gradually decreasing. The soil, when well drained and limed, is well adapted to red clover, alfalfa, sweet clover, and soy beans, and these crops should be grown more extensively to add needed organic matter and nitrogen and to improve the physical condition of the soil. The turning under of a leguminous crop, in connection with deeper plowing in the late fall, is reported by some of the better farmers on this soil as a very effective method of increasing its productiveness and improving its physical condition.

Lorain silty clay loam, dark-colored phase.—The virgin dry surface soil of Lorain silty clay loam, dark-colored phase, consists of grayish-black, rather mellow silty clay loam. This grades, at a depth of about 7 inches, to very dark gray silty clay loam underlain, at a depth of about 10 inches, by a 2-inch layer of dark-gray silty clay loam with yellowish-brown mottles. Below this is gray finely granular silty clay loam mottled with yellowish brown and brownish yellow. This grades, at a depth of about 15 inches, to gray silty clay

mottled with yellowish brown, and this material, at a depth ranging from 45 to 55 inches, is underlain by mottled gray and yellowish-brown laminated slightly calcareous silty clay.

About 98 per cent of the dark-colored phase of Lorain silty clay loam is tilled. Under normal moisture conditions the tilled soil, to a depth of 8 inches, is grayish-black mellow silty clay loam which when very wet is black. The soil is well supplied with organic matter and when well drained is very productive.

Lorain silty clay loam, dark-colored phase, is of small extent. It occurs in basinlike depressions along South Ridge between Madison and Unionville and north of Indian Point. The surface is flat, and drainage is naturally very poor.

Elm was the predominant tree in the virgin forests, and black ash, bur oak, sycamore, soft maple, willow, and swamp white oak were less numerous. The type of agriculture practiced and the suggestions offered for the improvement of Lorain loam, dark-colored phase, apply to this soil.

LORAIN LOAM

The upper soil layers of dry virgin Lorain loam consist of very dark grayish-black or very dark grayish-brown leaf mold 1 inch thick, grading to very dark-gray or very dark grayish-brown friable, mellow loam or very fine loam which between depths of 4 and 6 inches gradually becomes lighter in color, fading to dark-gray or dark brownish-gray loam or very fine loam. At a depth of about 8 or 10 inches, this rests on gray loam or fine sandy loam mottled with yellowish brown and light grayish yellow. This material grades, at a depth of about 18 inches, to mottled light-gray, brownish-yellow, and yellowish-brown very fine loam or loam. Below a depth of 22 inches the texture becomes silty clay loam and at a depth varying from 30 to 40 inches becomes silty clay. Below a depth varying from 55 to 65 inches is a layer of slightly calcareous light-gray silty clay mottled with brownish yellow and yellowish brown. Iron concretions are present in most places at a depth ranging from 20 to 30 inches.

Variations are present in many places. In these, stratified beds of fine gravel, of different-textured sand, and in places of silty clay occur below a depth varying from 15 to 30 inches. Immediately west and north of Perry areas of Lorain silt loam, and 1 mile northwest of Perry areas of Lorain gravelly loam, because of their small total extent, have been included in mapped areas of Lorain loam. Many very small areas of Caneadea loam, of Reynolds fine sandy loam, and of Reynolds very fine sandy loam have been included with this soil in mapping.

About 95 per cent of the Lorain loam is cultivated. The tilled soil differs from the virgin in that the surface layers have been mixed. Under normal moisture conditions the tilled soil to a depth of 8 inches consists of dark-gray or dark brownish-gray, friable, mellow loam or very fine loam. This is a warm, early, and fertile soil which can be easily worked into an excellent seed bed.

The larger areas of Lorain loam are between North and South Ridges in Madison and Perry Townships. Smaller areas occur between these ridges in Painesville and Mentor Townships and west of Salida. Areas are level, and the drainage is poor, but the com-

paratively free circulation of water through the friable subsoil layers allows excellent artificial drainage.

The virgin tree growth consisted of elm, soft maple, black ash, bur oak, willow, aspen, sycamore, and swamp white oak. Nursery stock, truck crops, corn, mixed alsike and timothy hay, and oats, named in the order of their importance, are the leading crops.

The methods of treatment recommended for Reynolds very fine sandy loam and Reynolds fine sandy loam are applicable to this soil.

Lorain loam, dark-colored phase.—Virgin, dry Lorain loam, dark-colored phase, to a depth of 1 or 2 inches consists of black muck. This is underlain by blackish-gray or grayish-black loam which grades to very dark gray loam at a depth of about 8 inches. Below a depth of about 12 inches is dark-gray fine sandy loam with grayish-yellow and yellowish-brown mottles. This grades at a depth of about 15 inches to gray fine sandy loam mottled with yellowish brown and brownish yellow, which passes at a depth of 20 inches into light-gray fine sandy loam with yellowish-brown mottles. This, at a depth varying from 50 to 60 inches, rests on mottled light-gray, yellowish-brown, and brownish-yellow slightly calcareous silty clay. In many places stratified beds of sand and gravel occur at different depths below 15 inches. As mapped, this soil includes small areas of the silty clay loam, silt loam, fine sandy loam, and very fine sandy loam of the Lorain series, of Reynolds fine sandy loam, and of muck.

Probably 95 per cent of the dark-colored Lorain loam is tilled. The cultivated soil differs in some particulars from the virgin, owing to the mixing of the surface layers. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, consists of grayish-black loam. Where drained, this is a warm, early, very productive soil with a good supply of organic matter.

Lorain loam, dark-colored phase, occurs in low, depressed areas along intermittent streams and in old swamps, ponds, and marshes between North and South Ridges in Madison and Perry Townships. The surface is flat and drainage is very poor, but the porosity of the soil material makes artificial drainage comparatively easy.

The original tree growth was dense. It consisted mainly of elm, aspen, sycamore, soft maple, black ash, bur oak, and willow. The production of nursery stock and of truck crops are the principal lines of agriculture practiced on this soil.

More thorough drainage is the principal need of the dark-colored Lorain loam. Many fields should have more tile, so that the crops might be seeded earlier and be cultivated even in wet seasons. The rotation of crops, the growing of legumes, and the use of some superphosphate (acid phosphate) would tend to maintain the natural productiveness of the soil.

LORAIN SILTY CLAY

In virgin areas of dry Lorain silty clay a thin layer of leaf mold is underlain by a 6-inch layer of very dark brownish-gray or very dark grayish-brown silty clay loam, which in turn is underlain by dark olive-gray silty clay, slightly mottled with gray and yellowish brown. This, at a depth of about 8 inches, grades to light-gray

silty clay mottled with yellowish brown which in turn grades, at a depth of about 10 inches, to gray, plastic, finely granular silty clay mottled yellowish brown and light gray. This material rests, at a depth of about 58 inches, on mottled light-gray, yellowish-brown, and brownish-yellow, slightly calcareous, brittle, friable silty clay containing small pebbles.

Electrometric determinations of the pH values of the different layers of typical virgin soil gave the following results: 5.71 from 0 to 6 inches, 5.82 from 6 to 8 inches, 5.82 from 8 to 10 inches, 6.59 from 10 to 58 inches, and 8.20 from 58 to 64 inches.

Approximately 85 per cent of the Lorain silty clay is tilled. The cultivated soil differs from the virgin, owing to an intermingling of the upper layers by plowing and to other modifications brought about through farm practices. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, is very dark grayish-brown or very dark brownish-gray silty clay, which when wet becomes distinctly darker in color.

The main areas of this soil occur immediately north of North Ridge between Mentor and Willoughby. A small area is 1 mile east of Willoughbeach. The surface is level and drainage is very poor. Because of the compactness and plasticity of the lower soil layer artificial drainage is difficult.

The original forest growth on Lorain silty clay consisted of white elm, soft maple, bur oak, swamp white oak, and black ash. The crops grown and the methods of treatment are the same as on Caneadea silty clay loam.

Lorain silty clay should be plowed late in the fall, when the moisture content is right, so that the upturned soil will disintegrate under the action of freezing and thawing. After liming, a good rotation for this soil consists of corn, soy beans, wheat, and sweet clover. The sweet clover should remain for one year, thus giving time for its heavy rooting system to penetrate downward and open up the plastic silty clay layers. In many places more tile are needed to remove the excess water more quickly. This would allow early seeding and more regular cultivation of crops.

LORAIN FINE SANDY LOAM, DARK-COLORED PHASE

The dry virgin surface soil of dark-colored Lorain fine sandy loam consists of black muck which, at a depth of 1 or 2 inches, is underlain by blackish-gray or grayish-black fine sandy loam grading, at a depth of about 7 inches, to a 2-inch layer of very dark gray fine sandy loam. Below a depth varying from 10 to 16 inches is gray loamy fine sand mottled with yellowish brown and brownish yellow. This grades to light-gray loamy fine sand mottled with grayish yellow, grayish brown, brownish yellow, and yellowish brown. This material continues to a depth ranging from 45 to 60 inches and is underlain by mottled light-gray, yellowish-brown, and brownish-yellow slightly calcareous silty clay. This soil is closely associated with Lorain loam, Berrien fine sand, Reynolds fine sandy loam, and muck and includes areas of these soils too small to separate on the soil map. In many places stratified beds of sand and gravel occur in

the substratum. These in some places are within 12 inches of the surface but in most places are below a depth of 18 inches.

Probably 98 per cent of the dark-colored Lorain fine sandy loam is under cultivation. The tilled soil differs from the virgin in that the surface layers have been mixed and other modifications have been brought about through cultivation. To a depth of 8 inches the cultivated soil, under normal moisture conditions, is grayish-black fine sandy loam. This soil is well supplied with organic matter and when well drained is warm, early, and very productive.

This soil is very inextensive. It occurs as low, poorly drained, long, narrow strips which extend parallel with North Ridge and lie immediately north of it in Perry and Painesville Townships and just northwest of West Mentor. The surface is flat, and the natural drainage is very poor. Before profitable yields can be had it is necessary to install tile drains or provide open ditches.

The virgin tree growth on this soil consisted of elm, aspen, sycamore, soft maple, black ash, bur oak, and willow. This soil is used almost exclusively for truck crops and nursery stock, and the yields obtained are above the average for the county.

REYNOLDS VERY FINE SANDY LOAM

In the dry virgin condition the surface layers of Reynolds very fine sandy loam consist of grayish-black or very dark brownish-gray vegetal mold 1 inch thick underlain by a layer of very dark gray or very dark brownish-gray very fine sandy loam which at a depth varying from 3 to 6 inches becomes dark gray or dark brownish gray. This, at a depth of 8 or 10 inches, grades to gray loamy very fine sand or light very fine sandy loam mottled yellowish brown and brownish yellow. This material continues to a depth varying from 48 to 60 inches, where it rests on slightly calcareous, mottled light-gray, yellowish-brown, and brownish-yellow silty clay. Many small areas of Lorain very fine sandy loam, of Lorain loam, and of Reynolds very fine sand and Reynolds fine sandy loam are included with this soil as mapped. In many places stratified beds of sand and gravel occur within a depth varying from 12 to 24 inches below the surface.

About 90 per cent of the Reynolds very fine sandy loam is tilled. The cultivated soil under normal moisture conditions consists of dark-gray or dark brownish-gray very fine sandy loam which becomes very dark gray when wet. When drained this is a warm, early and easily cultivated soil.

Reynolds very fine sandy loam occurs mainly immediately north of North Ridge in Painesville, Perry, and Madison Townships. Less important areas occur along intermittent drainage ways northeast of Buena Vista Beach. Areas are level or basinlike, and drainage is naturally poor, but owing to the sandiness of the soil layers artificial drainage can be established easily.

The virgin soil supported a tree growth consisting of white elm, soft maple, black ash, bur oak, willow, aspen, sycamore, and swamp white oak. This soil is devoted largely to the growing of truck crops and nursery stock. Corn, oats, and mixed alsike clover and timothy are grown to some extent. The yields are somewhat better

than the average for the county. Corn, according to the estimates of farmers, averages about 40 bushels to the acre, hay about 1 ton, and oats 45 bushels. About the same farm practices are pursued as on Caneadea loam.

Tests for acidity indicate that this soil is in need of about 2 tons of limestone to the acre. With drainage and the application of lime, clover and other legumes do well. By growing legumes, plowing under green-manure crops, and applying barnyard manure, supplemented with commercial fertilizers, the productivity can be improved.

Reynolds very fine sandy loam, light-textured phase.—In dry virgin Reynolds very fine sandy loam, light-textured phase, a layer about 1 inch thick of leaf mold is underlain by a 3-inch layer of light-textured dark-gray very fine sandy loam. Below this is dark-gray, light-textured very fine sandy loam which, at a depth of about 8 inches, grades to gray very fine sand mottled with yellowish brown and brownish yellow. This, at a depth ranging from 48 to 60 inches, rests on slightly calcareous mottled light-gray, yellowish-brown, and brownish-yellow silty clay.

About 75 per cent of this soil is cultivated. Under normal moisture condition the cultivated soil, to a depth of 8 inches, consists of dark-gray, light-textured very fine sandy loam, but when the moisture content is considerably above normal the color is very dark gray.

Areas of Reynolds very fine sandy loam, light-textured phase, are north and west of North Madison. This soil occurs along intermittent streams and in shallow, irregularly shaped basins, on lower situations than the lighter colored soils with which it is associated. The surface is level. Drainage is very poor but can be improved easily by tiling, owing to the openness of the soil material.

The original forest growth consisted of elm, soft maple, black ash, bur oak, willow, aspen, sycamore, and swamp white oak. The growing of nursery stock and of truck crops are the important types of farming. The suggestions offered for the improvement of the typical soil apply equally as well to this light-textured soil.

REYNOLDS FINE SANDY LOAM

The dry virgin surface soil of Reynolds fine sandy loam consists of a layer of leaf mold about 1 inch thick. This is underlain by a 3-inch layer of very dark gray or very dark brownish-gray fine sandy loam underlain, to a depth of 9 inches, by dark-gray or dark brownish-gray fine sandy loam. This grades to mottled light yellowish-gray, yellowish-brown, and grayish-yellow loamy fine sand which continues to a depth varying from 50 to 60 inches and is directly underlain by mottled light-gray, yellowish-brown, and brownish-yellow silty clay which contains some lime. Included with this soil as mapped, are numerous small areas of Lorain loam and of Reynolds fine sand and Reynolds very fine sandy loam. In many places layers of stratified sand and gravel, and in a few places of silty clay, occur within a depth ranging from 15 to 24 inches below the surface.

Approximately 85 per cent of the Reynolds fine sandy loam is cultivated. Under normal moisture conditions the tilled soil, to a

depth of 8 inches, is dark-gray or dark brownish-gray fine sandy loam which becomes very dark gray when wet. When properly tiled this soil is warm, early, and productive. It is well supplied with organic matter, and the openness of the soil layers allows the free movement of water and air.

This soil occurs for the most part in long, narrow belts along and parallel to North Ridge. Smaller areas are along South Ridge and west of Salida. The surface is level and drainage is poor, but because of the porosity of the soil layers artificial drainage can easily be established. The virgin tree growth on Reynolds fine sandy loam consisted of white elm, soft maple, black ash, bur oak, willow, aspen, sycamore, and swamp white oak. The agricultural practices on this soil, the crops grown, and the recommendations offered for its improvement are practically the same as have been given for Reynolds very fine sandy loam.

TRUMBULL SILTY CLAY LOAM

The dry virgin surface layer of Trumbull silty clay loam consists of a mixture of leaf mold, leaf litter, and humus soil one-half inch thick. This is underlain by a 1½-inch layer of dark olive-gray silt loam which rests on a 3-inch layer of light-gray rather firm silt loam mottled slightly with brown, yellowish brown, and brownish yellow. This material grades to light-gray, finely granular silty clay loam with mottles of brown, yellowish brown, and brownish yellow. At a depth of about 10 inches the material grades to plastic, granular, mottled light-gray, grayish-brown, and yellowish-brown silty clay which continues to a depth of about 30 inches, where compact, hard, brittle, mottled light-gray and yellowish-brown silty clay occurs. This, at a depth ranging from 50 to 60 inches, rests on mottled light-gray and yellowish-brown, compact, brittle, somewhat calcareous silty clay. In many places, especially in the vicinity of Hillhouse, the calcareous substratum is not present, but the shale beds are present at a depth varying from 60 to 80 inches.

Electrometric determinations of the pH values of the various layers of a typical virgin soil gave the following results: 4.29 from 0 to one-half inch, 4.59 from one-half to 2 inches, 4.60 from 2 to 5 inches, 4.62 from 5 to 10 inches, and 4.70 from 10 to 30 inches.

About 80 per cent of this soil in Lake County is tilled. Because of the mixing of the surface layers by plowing, modifications brought about by the application of stable manure and commercial fertilizers, and because of tiling, the cultivated soil, to a depth of 8 inches, consists of light-gray silty clay loam which appears gray when wet. This soil is acid, is very poor in organic matter, and is cold.

Trumbull silty clay loam occurs principally south of Grand River in Madison and Leroy Townships. Smaller areas are south of Concord and south of Wickliffe.

Areas of this soil are flat or very gently undulating. Both the natural run-off and internal drainage are slow, on account of the absence of slope and the compactness of the soil layers. Artificial drainage is difficult to establish.

The predominant virgin tree growth on this soil was hard maple, but beech, elm, white ash, black ash, bur oak, white oak, red oak, scarlet oak, basswood, hickory, and hemlock were also important.

The crops grown are the same as those on Mahoning silty clay loam, but the yields are somewhat lower.

Trumbull silty clay loam is currently valued at prices ranging from $50 to $70 an acre, depending on improvements and location with respect to good roads, transportation facilities, towns, and schools.

In general, the methods suggested for the improvement of Mahoning silty clay loam are well suited to this soil.

ALLIS SILTY CLAY LOAM

The dry surface material of virgin Allis silty clay loam consists of a layer, about one-half inch thick, of leaf mold and partly decayed leaves and other forest litter. This is underlain by a layer 1½ inches thick of light-gray silt loam. Beneath this is light yellowish-gray silt loam which, at a depth of about 4 inches, grades to light grayish-yellow silty clay loam. Between depths of 12 and 20 inches the material is mottled gray, yellow, brownish-yellow, and light reddish-brown plastic silty clay. From the surface to a depth of 20 inches some small, flat pieces of sandstone are present, but below this depth fragments of shale occur with the sandstone and the material is mottled gray, brownish-yellow, and light reddish-brown plastic clay which rests, at a depth varying from about 30 to 36 inches, on very fine grained sandstone interbedded with shale.

Owing to its intermediate position, the greater proportion of this soil varies from typical, on the one hand resembling Lordstown silt loam and on the other Trumbull silty clay loam. In some of the more sloping areas interbedded very fine grained sandstone and shale are nearer the surface. In such places where the sandstone predominates, the texture throughout the soil is mostly lighter, and the soil material is more friable and gravelly and shows less mottling than typical. Where the shale predominates, the surface layer, to a depth of 5 inches, is light-gray silt loam. This layer is underlain by light-gray silty clay loam mottled with yellowish brown or brownish yellow. This material, at a depth of 10 inches, gives way to plastic silty clay mottled light gray, yellowish brown, and light grayish yellow. This layer rests on the shale. On level stretches where the interbedded sandstone and shale substratum is deeper than typical, the soil is very similar to Trumbull silty clay loam to a depth of 3 feet. Below this depth it contains numerous fragments of sandstone and shale, is rather friable, and is very acid.

Electrometric determinations of the pH values of the different layers of typical virgin soil gave the following results: 4.18 from 0 to one-half inch, 4.18 from one-half to 2 inches, 4.41 from 2 to 4 inches, 4.39 from 4 to 12 inches, 5.01 from 12 to 20 inches, and 5.02 from 20 to 30 inches.

About 10 per cent of the Allis silty clay loam in Lake County is tilled. Cultivation has modified the virgin soil by mixing the surface layers. Other changes have been brought about through the application of commercial fertilizers, barnyard manure, and green manure, and by tiling. Under normal moisture conditions the cultivated soil, to a depth of 8 inches consists of light-gray silty clay loam, carrying more or less small, flat fragments of very fine grained sandstone. When the moisture content is above the average,

the color is darker. This soil is deficient in organic matter, is cold, and is very acid. It is very important that it be worked when the moisture content is right for pulverization.

Allis silty clay loam occurs principally southeast of Kirtland, about Little Mountain, and south of Concord. The surface is level, gently sloping, and sloping. Drainage is poor.

In the virgin areas hard maple and birch are the predominating trees, and hickory, scarlet oak, black oak, red oak, white oak, white ash, and basswood and in the wetter areas bur oak, white elm, and black ash are of less importance. When cultivated fields are abandoned pin oak becomes important.

Corn, mixed alsike clover and timothy hay, oats, apples, pears, and grapes are the most important crops grown on this soil. Yields of corn average about 25 bushels to the acre, of hay three-fourths ton, and of oats 35 bushels.

The methods of cultivation and fertilization employed on this soil are similar to those described for Mahoning silty clay loam.

The value of this land depends very largely on the desirability of its location for country estates. Selling prices, which have little or no relation to strictly agricultural values, range from $500 to $1,000 an acre.

This soil is especially in need of available organic matter, of lime, and of better drainage. Suggestions offered for the improvement of Mahoning silty clay loam apply equally as well to this soil, except that the lime requirement for this soil is higher, averaging about 5 tons to the acre of finely pulverized limestone.

Allis silty clay loam, rolling phase.—The rolling phase of Allis silty clay loam is similar to typical Allis silty clay loam in its soil characteristics. The distinction in mapping was purely topographic. Areas of this soil, as the name implies, are rolling or sloping.

LORDSTOWN LOAM

Virgin Lordstown loam, when dry, consists of a ½-inch layer of forest litter, humus soil, leaf mold, and fine grass roots, below which is a 2-inch layer of grayish-brown fine sandy loam or loam underlain by light grayish-yellow or yellow loam which, at a depth ranging from 1 to 3 feet, rests on disintegrated beds of fine-grained sandstone.

About 50 per cent of the Lordstown loam is cultivated. The cultivated soil differs from the virgin in that the surface layers have been mixed and other modifications have been brought about through tillage. Under average moisture conditions the cultivated soil, to a depth of 8 inches, is light yellowish-brown friable loam. Because of the friability of all the soil layers this is an especially early, warm, and easily cultivated soil.

Lordstown loam occurs on hill slopes in the vicinities of Little Mountain and Gildersleeve Mountain. Drainage is very good.

The virgin forest growth and the crops grown are about the same as on Lordstown silt loam. In the improvement of this soil the inclusion of legumes in the rotation is especially important as a means for increasing the content of organic matter. The lime requirement is about 3 tons of limestone to the acre.

LORDSTOWN FINE SANDY LOAM

Virgin Lordstown fine sandy loam, when dry, consists of a ½-inch layer of leaf mold, fine grass roots, and partly decayed leaves and pieces of wood, grading to grayish-brown fine sandy loam which, at a depth of about 2½ inches, passes into light grayish-yellow or yellow fine sandy loam underlain, at a depth ranging from 10 to 30 inches, by disintegrated sandstone. Fragments of fine-grained sandstone are found throughout the soil.

In this county about 25 per cent of the Lordstown fine sandy loam is tilled. In cultivated fields the material of the surface soil differs from that in the virgin condition, owing to the mixing of the upper layers and to modifications of chemical composition and structure through the application of stable manure and commercial fertilizers and the turning under of green-manure crops. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, is light grayish-yellow or grayish-brown fine sandy loam which becomes darker when wet. Because of the openness of both topsoil and subsoil, this soil is warm, early, and well adapted to early vegetables.

Lordstown fine sandy loam occurs on hilltops and the upper slopes of hills on and in the vicinities of Little Mountain and Gildersleeve Mountain. Drainage is good.

The trees on this soil, as well as the prevailing crops and agricultural practices, are very similar to those on Lordstown silt loam. One of the great needs of the soil is rapidly decomposing organic matter, which can be supplied by the application of barnyard manure and by plowing under green-manure crops, the legumes being preferable. This will improve the physical condition of the soil and increase its productiveness.

LORDSTOWN SILT LOAM

In the virgin state, when dry, the surface material of Lordstown silt loam consists of a ½-inch layer of leaf mold mixed with numerous fine grass roots and partly decayed leaves and pieces of wood. This is underlain, to a depth of 7 inches, by grayish-brown or dark grayish-brown, friable silt loam which with increasing depth becomes gradually lighter in color and heavier in texture and grades to a 17-inch layer of light grayish-yellow or yellow, friable silty clay loam underlain by mottled yellow, light-gray, and yellowish-brown friable stony loam. Below this, at a depth of about 33 inches, is disintegrated fine-grained sandstone. Irregular fragments of fine-grained sandstone, ranging in diameter from 1 to 6 inches, are scattered over the surface and throughout the soil.

About 50 per cent of the Lordstown silt loam is under cultivation. The cultivated soil differs from the virgin in that there has been a mixing of the surface layers, and other changes have developed through the use of manure and commercial fertilizers. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, consists of light grayish-brown or light yellowish-brown mellow silt loam, but where the moisture content is above normal

the color is darker. The soil is warm, early, and easy to cultivate under a fairly wide range of moisture conditions.

This soil occurs in small areas in the vicinity of Little Mountain and south of Concord. It characteristically occupies the slopes of hills, and drainage is fair or good.

In the virgin areas chestnut and hard maple were the predominating trees, and hickory, red oak, scarlet oak, white oak, tulip, white ash, hemlock, and basswood were of less importance. Corn, timothy mixed with alsike and red clover, oats, apples, pears, and peaches are the principal crops.

This soil is managed and fertilized in practically the same way as Mahoning silty clay loam. Under cultivation the organic matter content of the soil is soon depleted, and in most places the incorporation of available organic matter in the form of green manure is much needed. The acidity can be corrected by thoroughly mixing with the soil from 3 to 4 tons of finely pulverized limestone to the acre.

CHIPPEWA SILTY CLAY LOAM

In dry, virgin Chippewa silty clay loam a ½-inch layer of a mixture of silt mold, partly decayed leaves and pieces of wood, and numerous very fine grass roots is underlain by dark-gray silt loam which becomes lighter in color and heavier with depth and grades, at a depth of about 6 inches, to fine, granular, gray silty clay loam mottled with yellowish brown. Between depths of 10 and 30 inches is a layer of plastic, fine, granular silty clay loam or silty clay, mottled light yellowish gray, brownish yellow, and light grayish yellow. This rests on a layer, from 20 to 30 inches thick, of hard, brittle, light grayish-yellow silty clay, mottled with light gray and light yellowish gray, which grades to mottled light-gray, light yellowish-gray, light grayish-yellow, and brownish-yellow silty clay containing some lime.

About 90 per cent of the Chippewa silty clay loam is cultivated. The cultivated soil differs from the virgin in that the surface layers have been mixed and other modifications have been brought about through cultivation. Under normal moisture conditions the soil, to a depth of 8 inches, is dark-gray, mellow, heavy silt loam or light silty clay loam. It has a good supply of organic matter, and the moisture-holding capacity, with proper underdrainage, is such that the crops rarely suffer seriously from lack or from excess of moisture.

Chippewa silty clay loam occurs in small areas east of Perry, south of Hillhouse, and south of Gildersleeve Mountain. The surface is level, and drainage is very poor.

Virgin areas supported a forest growth of soft maple, white elm, black ash, bur oak, and swamp white oak. The prevailing crops and agricultural practices are very similar to those on Mahoning silty clay loam. The yields are somewhat higher.

For improving and maintaining the fertility of this soil, tiling, liming, and the growing of more legumes are important. In many particulars the suggestions offered for the improvement of Mahoning silty clay loam apply to this soil.

TYLER SILTY CLAY LOAM

The dry upper soil layers of virgin Tyler silty clay loam consist of dark olive-gray silt loam grading, at a depth of about 2 inches, to brownish-gray silt loam which, at a depth of about 8 inches, is underlain by gray, mottled yellowish-brown, light yellowish-gray, and grayish-yellow light silty clay loam. The mottles become more pronounced and the texture heavier to a depth of about 15 inches. Below this depth the material is mottled light-gray, gray, and yellowish-brown silty clay loam. At a depth of about 24 inches the texture in most places becomes somewhat lighter. Below a depth of about 50 inches the material is mottled light-gray, light grayish-yellow, and light yellowish-gray silty clay loam.

On the terraces of Chagrin River near the Cuyahoga County line, and of Grand River near Fairport Harbor, are areas of Tyler silt loam which because of their small aggregate area have been included in mapped areas of Tyler silty clay loam. Very small areas of Braceville silty clay loam, silt loam, and loam have also been included in mapped areas of this soil. In these, beds of gravel and sand occur at a depth ranging from 2 to 4 feet.

About 40 per cent of the Tyler silty clay loam is tilled. In cultivated fields the material differs from that in the virgin condition in that the surface layers have been mixed, and other modifications have been brought about through cultivation. Under normal moisture conditions the soil, to a depth of 8 inches, is brownish-gray silt loam which becomes dark when wet.

Tyler silty clay loam occurs on terraces along Chagrin and Grand Rivers. Areas are level or gently sloping toward the streams. Drainage is poor.

The virgin forests consisted of elm, bur oak, soft maple, black ash, and swamp white oak. Corn, mixed alsike clover and timothy, and oats are the important crops. The average yield of corn is about 40 bushels to the acre, of hay about 1 ton, and of oats 45 bushels.

Important steps in the improvement of this soil include more tiling and the restoration and maintenance of the supply of actively decomposing organic matter by growing legumes, turning under green-manure crops, and applying stable manure.

WICKLIFFE SILTY CLAY

The dry surface material of virgin Wickliffe silty clay consists of a ½-inch layer of a mixture of partly decayed leaves, leaf mold, sand, silt, and clay underlain by gray silty clay which, at a depth of 1½ inches, gives way to a 3-inch layer of plastic, light yellowish-gray silty clay. This is underlain by mottled whitish-gray, brownish-yellow, light brownish-yellow, and light yellowish-gray, heavy, plastic silty clay which at a depth of about 12 inches grades to whitish-gray heavy, plastic clay mottled with brownish yellow and yellowish brown. This material continues to a depth varying from 36 to 80 inches, but in most places from 50 to 65 inches, where bluish-gray weathered shale, streaked with yellowish brown and brownish yellow occurs.

Electrometric determinations of the pH values of the various layers of the typical virgin soil gave the following results: 5.11 from 0 to one-half inch, 4.87 from one-half to 2 inches, 4.70 from 2 to 5 inches. 4.51 from 5 to 12 inches, 4.54 from 12 to 70 inches, and 4.21 from 70 to 76 inches.

About 2 per cent of the Wickliffe silty clay is tilled. Under normal moisture conditions the cultivated soil, to a depth of 8 inches, consists of light yellowish-gray silty clay.

Wickliffe silty clay occurs in the northwestern corner of Lake County. Owing to the predominatingly level surface, the surface run-off is very slow, and the compact, plastic, impervious soil layers impede very greatly the movement of ground water, so that drainage is difficult to establish. A conspicuous characteristic of the surface soil is that, when thoroughly wet, it retains the water for a long time, but when it becomes dry it is so dense that water enters it slowly and absorption is hardly noticeable except during long rains.

Elm predominated in the virgin tree growth, and soft maple, bur oak, swamp white oak, black ash, sycamore, and quaking aspen were less numerous.

Owing to subdivision developments for residential purposes, Wickliffe silty clay is not farmed but is used to some extent for small family gardens.

WICKLIFFE SILTY CLAY LOAM

The dry surface layers of virgin Wickliffe silty clay loam consist of a thin covering of leaf mold, leaf litter, sand, silt, and clay, underlain by a 3-inch layer of gray silty clay loam, beneath which is light yellowish-gray silty clay loam. Below a depth of about 7 inches is mottled whitish-gray, brownish-yellow, light brownish-yellow, and light yellowish-gray silty clay, which continues to a depth of 15 inches. Below this, to a depth ranging from 36 to 80 inches, is whitish-gray plastic silty clay mottled with brownish yellow and yellowish brown. This layer rests on the weathered shale. Included with this soil, as mapped, are small areas of the loam, silt loam, and clay members of the Wickliffe series.

Wickliffe silty clay loam occurs only in the northwestern corner of the county. The surface is level and drainage is very poor. The soil is not farmed, but is used for residential purposes.

CHAGRIN SILT LOAM

Dry Chagrin silt loam, in both the virgin and cultivated states, consists of brown or rather dark brown mellow silt loam which grades, at a depth of about 8 inches, to somewhat lighter colored material of slightly heavier texture. This continues to a depth of 4 or more feet.

This soil is characterized by many local textural variations which can not be shown on the map. The surface soil ranges in texture from loam to silty clay loam. In places the material below a depth of 15 inches is yellowish brown in color, and in other places faint mottles of yellowish brown and grayish brown occur below a depth of 24 inches. Small inclusions of Chagrin silty clay loam and of Holly silt loam and Holly silty clay loam are common in mapped

areas of this soil. Along Chagrin River and East Branch Chagrin River are a number of areas of Chagrin silt loam. These total about 2 square miles in extent and are not subject to overflow, except possibly once in 20 years. Because of their small extent Chagrin loam, Chagrin fine sandy loam, and Chagrin very fine sandy loam have been included in mapped areas of Chagrin silt loam. Chagrin loam, which occupies a total area of about 1 square mile, occurs in the bottoms of East Branch Chagrin River and in the southern part of the county. This soil consists of brown or dark-brown friable loam underlain by beds of brown loam, silt loam, fine sandy loam, and fine sand.

Chagrin silt loam occurs on the flood plains along Chagrin and Grand Rivers and their tributaries. The surface, in general, is level or gently sloping toward the stream, but in places is cut by sloughs. The soil is subject to inundation, but drainage is fairly good.

The virgin forest growth consisted of elm, soft maple, oak, sycamore, willow, and hickory. About 50 per cent of this soil is devoted to the production of corn, oats, mixed clover and timothy, and truck crops. The average yield of corn is about 45 bushels to the acre, of hay about 1½ tons, and of oats about 45 bushels.

In the management of Chagrin silt loam many farmers apply about 125 pounds of superphosphate (acid phosphate) to the acre for corn and wheat and 400 pounds for potatoes.

HOLLY SILTY CLAY LOAM

The dry surface soil of virgin Holly silty clay loam consists of brownish-gray silt loam about 2 inches thick. This grades to a 4-inch layer of brownish-gray or gray silt loam or light silty clay loam underlain by gray silty clay loam mottled with yellowish brown and light yellowish gray. The mottling in this layer becomes more pronounced and the texture somewhat heavier to a depth of about 12 inches, where mottled light-gray, gray, yellowish-brown, and rust-brown, rather plastic silty clay loam or silty clay occurs. This continues to a depth of 48 or more inches.

Many textural variations occur in this soil. In places the lower layers are fine sandy loam, and in some places beds of sand or fine gravel occur between a depth of 2 and 4 feet. There are included small areas of peat and muck, usually marking the sites of sloughs, and narrow strips of Chagrin fine sandy loam, Chagrin loam, and Chagrin silt loam, which occur along the stream banks. Included with this soil, as mapped, are small areas of both alluvial and colluvial materials occurring in the valleys of small streams. In such places the material adjacent to the stream is commonly alluvial, and that lying at the base of the valley slope is colluvial, but in the ravines these two classes of materials have been mixed. Between Chagrin River and East Branch Chagrin River just south of Willoughby, there is about one-half square mile of Holly silty clay loam which is not subject to overflow.

Holly silty clay loam occurs south of South Ridge in the flood plains of the tributaries of Chagrin and Grand Rivers. The surface is flat or gently sloping toward the stream except in sloughs,

tributary stream channels, and scattered depressions and inequalities caused by erosion from overflow water. The natural drainage is poor.

Probably 2 per cent of this soil is under cultivation. For the most part the timber has been removed and the soil is used for permanent pasture. The wooded sections support a growth of swamp maple, black ash, elm, and willow. On account of the frequent inundations, it is probable that the best use that can be made of Holly silty clay loam is for permanent pasture.

HOLLY SILT LOAM

Holly silt loam, when dry, has a surface layer of brownish-gray or grayish-brown silt loam 8 or 10 inches thick underlain by gray or brownish-gray material mottled with gray and yellowish brown. In places layers of fine sand, fine sandy loam, very fine sand, or very fine sandy loam occur in the subsoil.

This soil occurs in the flood plains along Grand River near Fairport Harbor and along East Branch Chagrin River 1 mile southeast of Willoughby. The surface is flat, and drainage is naturally poor.

This soil is used largely for permanent pasture.

MUCK

Muck in Lake County, to a depth varying from 8 to 12 inches, consists of black, nonfibrous, very finely divided, partly decomposed vegetable matter containing a rather high percentage of fine and very fine sand, silt, and clay. Below this layer is brown or black, slightly fibrous organic material which, at a depth ranging from 15 to 40 inches, rests on gray fine sand or very fine sand. In many places the slightly fibrous layer is missing, and the fine or very fine sand occurs at a depth of 10 or 12 inches.

In a small area of muck one-half mile northeast of Eagles Mill the black organic matter is underlain at a depth varying from 8 to 18 inches by very light gray or almost white marl.

Muck occurs in Lake County only in long, narrow areas, most of them extending parallel to North Ridge and lying along its north base. The surface is flat or basin shaped, and the drainage is very poor. Practically all of the muck is used for growing nursery stock and truck crops.

PEAT

Peat, as mapped in Lake County, consists of the remains of Sphagnum moss, grasses, sedges, and other vegetable matter in various stages of decomposition and disintegration. It is brown, very fibrous, organic material that contains numerous roots, partly decayed plants, and very little inorganic material.

Peat in Lake County occurs almost entirely in the Mentor Marsh. The surface is flat and the drainage is extremely poor, the groundwater level in most places being very near the surface.

Peat is not farmed but furnishes some pasture for livestock. In drier areas it supports a tree growth of pin oak, soft maple, black

ash, willow, and elm, and in the wetter areas black ash, tamarack, and shrubs, consisting of poison sumac, alder, and high-bush huckleberry thrive.

Until drained, peat can not be used for agricultural purposes, but with proper drainage and fertilization it will be found adapted to celery, onions, and cabbage.

MARSH

Marsh includes lands bordering Lake Erie which are under water most of the time and which are not otherwise classified. In Lake County one area, about 4 miles southwest of Fairport Harbor, is mapped. This land has no agricultural value at present.

ROUGH BROKEN LAND

The term rough broken land applies to precipitous bluffs, very steep valley and gully slopes, and terrace escarpments where the degree of slope is inhibitive to any cultivation. On these slopes are numerous outcrops of shale and sandstone, in many places appearing as vertical bluffs.

Probably 95 per cent of the rough broken land is covered with trees, consisting of hard maple, hemlock, basswood, tulip, beech, red oak, black oak, white oak, bur oak, white ash, hickory, soft maple, dogwood, ironwood, black walnut, butternut, and cucumber.

These slopes are suitable only for permanent pasture and forestry.

SUMMARY

Lake County is in the northeastern part of Ohio. In it there are two distinct physiographic divisions, the level plains, representing the beds of old glacial lakes, and an undulating and rolling region.

The drainage waters, except for some small streams that empty directly into Lake Erie, flow into Chagrin and Grand Rivers and thence into Lake Erie.

The population of Lake County is 28,667, according to the census of 1920. The county is served by three railroads, one interurban line, autobus lines, and a system of water-bound pikes, macadam, gravel, and cinder roads that reach all parts.

Because of its proximity to Cleveland, Lake County has an excellent market for all farm products.

The climate is temperate, with rather short periods of extreme heat and cold. The frost-free season is almost two months longer near the shore of Lake Erie than in the undulating and rolling region in the southern part of the county.

The agricultural industries, ranked acording to their importance, are the production of nursery stock, general farming in support of dairying, trucking, and the production of fruits and berries. The general farm crops grown, in the order of their acreage, are mixed timothy and clover hay, oats, corn, wheat, and potatoes. These crops are generally grown in rotation as corn or potatoes, oats or wheat, then grass.

The soils of Lake County are prevailingly light in color, and have been formed under a dense forest cover.

The soils of the undulating and rolling upland in the southern part of the area are classed in five series, the Mahoning, Trumbull, Chippewa, Lordstown, and Allis.

The soils of the lake-bed plains are classified in seven soil series, the Berrien, Caneadea, Lorain, Wickliffe, Reynolds, Painesville, and the beach-ridge phases of the Chenango.

Soils occupying outwash plains and stream terraces are classed in the Chenango, Mentor, and Tyler series.

The flood-plain soils are classed in the Chagrin and Holly series.

Muck consists of partly decayed vegetable matter containing a high percentage of fine and very fine sand. Muck is used for the production of nursery stock and truck crops.

Peat consists of brown, very fibrous, partly decayed organic matter. It is not cultivated.

Marsh includes wet lands bordering Lake Erie, which are not otherwise classified.

Rough broken land includes areas too precipitous to be suitable for any use except pasture and forestry.

○

[Public Resolution—No. 9]

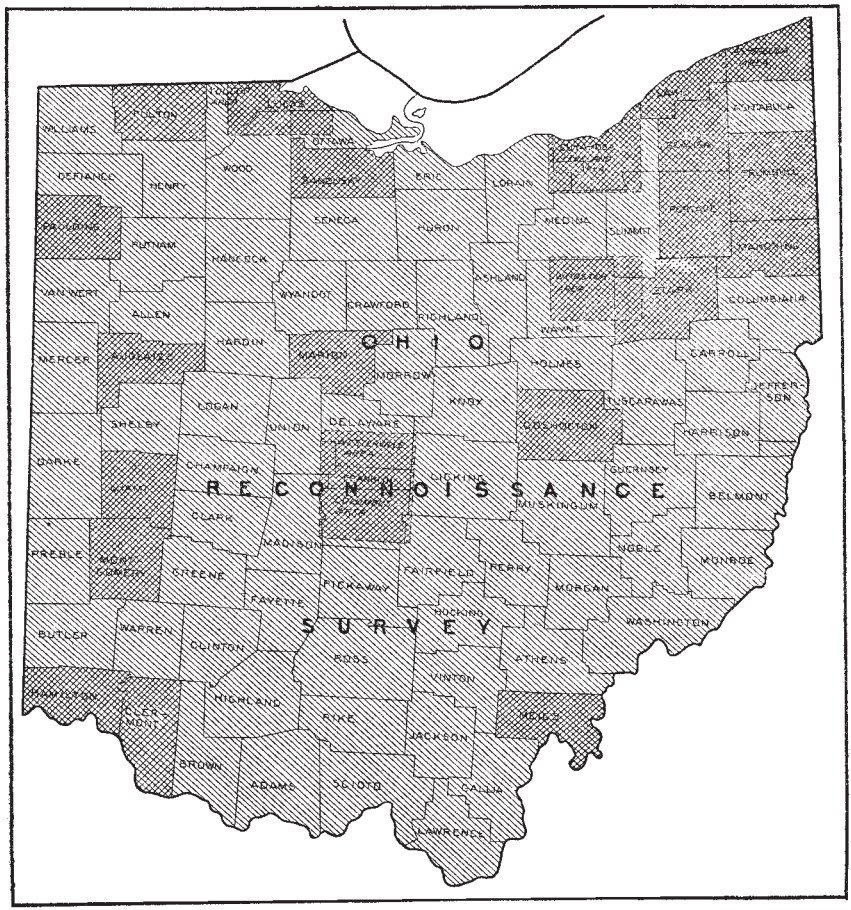
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Ohio, shown by shading

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
LAKE COUNTY
OHIO

OHIO AGRICULTURAL EXPERIMENT STATION
C. G. WILLIAMS, DIRECTOR
R. M. SALTER, CHIEF, DEPARTMENT OF AGRONOMY
G. W. CONREY, IN CHARGE SOIL SURVEY

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Railroads, Steam and Electric (DOUBLE TRACK, SINGLE TRACK, ELECTRIC ROAD, R. R. ABOVE, R. R. BELOW)
- Bridges, Ferry
- R.R. crossings, Tunnel
- Ford, Dam
- School or Church, Cemeteries
- Mine or Quarry, Mine dumps, Made land
- Bluff, Escarpment, Rock outcrop, and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines (STATE, COUNTY)
- Boundary lines (LAND GRANT, CITY OR VILLAGE)
- Boundary lines (CIVIL TOWNSHIP, RESERVATION)
- U.S. township and section lines

RELIEF
(Printed in brown or black)

- Contours, Depression contours
- Prominent Hills, Mountain Peaks
- Sand, Wash, and Sand dunes
- Shore and Low-water line, Sandbar

DRAINAGE
(Printed in blue)

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

LEGEND

- Allis silty clay loam — As
- Chenango gravelly fine sand, Beach-ridge phase — Ch
- Mahoning silty clay loam — Ma
- As — Rolling phase
- Chenango gravelly fine sandy loam, Beach-ridge phase — Co
- Ms — Rolling phase
- Berrien fine sand — Bs
- Chenango very fine sandy loam — Cv
- Mentor loam — Ml
- Bs — Beach-ridge phase
- Chenango gravelly loam — Cg
- Mentor silt loam — Ms
- Berrien very fine sand — Bv
- Cg — Beach-ridge phase
- Ms — Mottled-subsoil phase
- Caneadea fine sandy loam — Cf
- Chenango loam — Cl
- Painesville fine sandy loam — Pf
- Cf — Light-textured phase
- Holly silt loam — Hl
- Painesville very fine sandy loam — Pv
- Caneadea very fine sandy loam — Cy
- Holly silty clay loam — Hl
- Painesville silt loam — Ps
- Caneadea loam — Cm
- Lorain fine sandy loam, Dark-colored phase — Ly
- Reynolds fine sandy loam — Rf
- Cm — Gravelly phase
- Lorain loam — Lo
- Reynolds very fine sandy loam — Rl
- Caneadea silt loam — Ca
- Lo — Dark-colored phase
- Rl — Light-textured phase
- Caneadea silty clay loam — Cs
- Lorain silty clay loam — Lm
- Trumbull silty clay loam — Ts
- Cs — Dark-colored phase
- Lm — Dark-colored phase
- Tyler silty clay loam — Ty
- Caneadea silty clay — Cc
- Lorain silty clay — Lc
- Wickliffe silty clay loam — Wl
- Cc — Dark-colored phase
- Lordstown fine sandy loam — Lf
- Wickliffe silty clay — W
- Chagrin silt loam — Ct
- Lordstown loam — Ll
- Marsh — Mh
- Chippewa silty clay loam — C
- Lordstown silt loam — Ls
- Rough broken land — Rb
- Muck — Mu
- Peat — P

Mark Baldwin, Inspector, District 1.
Soils surveyed by Arthur E. Taylor.

BASE MAP FROM
U. S. GEOLOGICAL SURVEY SHEETS

Scale 1/62500
1 1/2 0 1 2 3 4 Miles
1 1/2 0 1 2 3 4 5 Kilometers
Contour interval 20 feet.
Datum is mean sea level.

Field Operations
Bureau of Soils
1925